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An Advanced Organometallic Lab Experiment with Biological Implications: Synthesis and Characterization of $\text{Fe}_2(\mu\text{-S}_2)(\text{CO})_6$

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(Revised September 2015)

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The *Journal of Chemical Education* (*JCE*) is a monthly, subscription-only journal that publishes peer-reviewed articles and related information as a resource to those engaged in teaching and learning chemistry and to the institutions that serve them. *JCE* typically addresses chemical content, laboratory experiments, instructional methods, and pedagogies. *JCE* is published online and in print and has electronic archival content available from 1924 (Vol. 1) to the present. The worldwide audience includes instructors of chemistry from middle school through graduate school as well as professional staff who support teaching activities, and scientists in commerce, industry, and government.

REQUIREMENTS FOR PUBLICATION

The criteria for a publishable manuscript include these areas of evaluation: scholarship, novelty, pedagogy, utility, and presentation. To be considered for publication by *JCE*, a manuscript must:

- Demonstrate scientific and scholarly rigor, supported by up-to-date citations to relevant literature and guided by a rationale for how the work fits into existing knowledge
- Exhibit novelty through original scholarship or a creative or innovative practice
- Have pedagogical content and educational relevance and insight that demonstrates a positive impact on teaching and learning while articulating audience level, use with students, and details for adopting and adapting the material, if applicable
- Be useful to *JCE* readers by showing a connection to teaching and learning within the context of curricula or coursework
- Present well-developed ideas in a comprehensive, organized discussion written in clear, concise English and making effective use of display elements (figures, schemes, tables, etc.)
- Adhere to the requirements and *JCE* protocols outlined in this document for each respective manuscript type and be submitted according to ACS publishing policies

- Be submitted electronically using [ACS Paragon Plus](#)

MANUSCRIPT TYPES

The *Journal of Chemical Education* publishes a wide variety of scholarly content categorized by manuscript type. All manuscripts must be submitted using an appropriate type. Please observe the maximum word count associated with each manuscript type; these word counts exclude Supporting Information, which is material published separately only online.

Activity

An activity (2000 words) describes a hands-on activity at any level (from elementary through the university level) that can be done in the classroom or laboratory, or in informal settings. Materials used should be inexpensive, nonhazardous, and readily available. These activities are intended to be engaging and thought-provoking introductions to new ideas or topics and to spark discussion. Supporting Information to aid in the use of the activity by others is required; for example, notes for instructors (including sources for materials used) and student handouts.

Additions and Corrections

Although authors must make certain that their material is accurate and correct, necessary changes to their published material are acknowledged and documented through this type. Additions and Corrections may be used to address important issues or correct errors and omissions of consequence that arise after publication of an article. Additions and Corrections may be requested by the author(s) or initiated by the Editor after discussions with the corresponding author. Readers who detect errors of consequence in the work of others should contact the corresponding author of that work. All Additions and Corrections are subject to approval by the Editor, and minor corrections and additions will not be published. Additions and Corrections from authors should be submitted via the ACS Paragon Plus environment by the corresponding author for publication in the "Addition/Correction" section of the Journal. The corresponding author should obtain approval from all of the article coauthors prior to submitting an Addition and Correction, or provide evidence that such approval has been solicited. The Addition and Correction should include the original article title and author list, citation including DOI, and details of the correction. For proper formatting, see examples in a current issue of the Journal.

Article

An article (5000 words) describes a novel educational idea or approach, content for the classroom or laboratory, pedagogical advance, or educational research. Invited articles may review a broad topic area that has wide applicability. Articles can target specific constituencies (i.e., precollege or introductory or advanced college students), address a specific content area, describe a new pedagogy or teaching method, or provide results on an innovation or chemical education research study. Articles specific to reporting the research pertaining to teaching and learning chemistry (chemical education research, CER) have [specific content requirements stated in a separate document](#).

Book and Media Review

Book and media reviews (800 words) of interest to educators or of use in the teaching or learning of chemistry are published using this manuscript type. Reviews should provide informed guidance concerning textbooks, software, and multimedia resources that might be adopted in courses or books to be recommended for library or individual purchase.

Commentary

Scholarly discussions of a topic of interest to the chemical education community that include the opinions of the author(s) are published using the manuscript type Commentary (2000 words). The manuscript should provide sufficient information for readers to understand the topic or formulate their own opinions.

Communication

Communications (2000 words) generally update or extend topics addressed in manuscripts that have already been published. For Communications pertaining to laboratory experiments, the focus should be on student experiences as they pertain to the update. The ways in which the update is interesting, useful, and novel should be made clear. Manuscripts of this type are not intended as precursors to articles.

Demonstration

A description, explanation, and procedure for an actual or virtual demonstration for teaching chemistry concepts, Demonstrations (2000 words) must reflect best practices related to safety (i.e., handling and storage of chemicals) and to hazards (i.e., fires, explosions, noxious fumes), as well as complete documentation that will enable others to use the demonstration in their settings. (This information may be placed in a Supporting Information document.)

Editorial

Editorials (1000 words) are opinion pieces by the editor-in-chief, an associate editor, or a guest writer invited by the editor-in-chief.

Laboratory Experiment

Laboratory Experiment (3000 words) manuscripts are intended to help readers visualize their students performing an experiment. Thus, labs need to have been done with students as part of an actual lab curriculum. Information about how the experiment was conducted with students should be provided, including the number of students who participated, whether the students worked individually or in groups, the number of times the experiment was run, and the time it took to complete the experiment. Procedures should be summarized, and hazards and precautions should be addressed. There should also be an assessment of how the experiment improved the learning process of students and whether the pedagogical goals were achieved. Student experiences should be described and instructor comments noted. The lab should be placed within the context of experiments that have been published. Novelty is a crucial consideration: The pedagogical contribution that the reported experiment provides should be made clear.

Supporting Information must accompany the manuscript; it should contain material that a reader would find necessary to carry out the lab, such as student handouts, instructor notes, detailed procedures, CAS numbers, pre- and postlab assessments, and data (whether representative student data or “idealized” author data). An editable version of the Supporting Information (i.e., Word document) should be provided; this format is convenient for instructors who adapt or modify the lab.

In general, laboratory experiments are exempt from Institutional Review Board (IRB) approval because these experiments do not involve human subjects. If there is a question regarding exemption, authors should consult their IRB. If IRB approval is required, it should be indicated in the manuscript that such approval was obtained.

Letters

A manuscript type that allows readers to respond to a piece that has been published in *JCE*, Letters (400 words) should contribute to or elicit discussion on a subject without overstepping the bounds of professional courtesy.

Retractions

Articles may be retracted for scientific or ethical reasons. Articles that contain seriously flawed or erroneous data such that their findings and conclusions cannot be relied upon may be retracted in order to correct the scientific record. Retractions may be requested by the article author(s) or by the journal Editor(s), but are ultimately published at the discretion of the Editor. When an article is retracted, a notice of Retraction will be published containing information about the original article title, author list, and the reason for the Retraction. Retracted articles will be accompanied by the related Retraction notice and will be marked as “Retracted”. The originally published article will remain on the web except in extraordinary circumstances (e.g. where deemed legally necessary, or if the availability of the published content poses public health risks). The American Chemical Society follows guidance from the Committee on Publication Ethics (COPE) when considering retractions; for more information see: <http://publicationethics.org/>.

Technology Report

A Technology Report (1600 words) provides a brief description of a Web site, software application, media item, or other use of technology in enhancing teaching and learning. The manuscript text describes the item and its intended use with students and provides the URL for Web-based resources, as appropriate. For all other applications described, the actual technology item should be included as Supporting Information for Publication (e.g., Excel worksheet, Flash animation, Mathematica program file).

MANUSCRIPT COMPONENTS

The components described below may appear in any type of manuscript. Using [the template for manuscripts](#) is strongly encouraged. To ensure the completeness of your submission, please review the Author Checklist at the end of this document.

Title

Titles should clearly and concisely reflect the emphasis and content of the manuscript and be accessible to a broad audience. The title should not contain jargon, symbols, trademark, brand, or institution names, or abbreviations. Discouraged terms include “new”, “first”, “green”, and part or series numbers. If possible, indicate the audience and the setting if that is significant. A well-crafted title aids in successful information retrieval.

Author List

Include all those who made substantial contributions to the work. To facilitate indexing and retrieval and for unique identification of an author, use given (first) names, initials, and surnames (e.g., John R. Smith) or first initials, second names, and surnames (e.g., J. Robert Smith). One author must be designated as the person to whom correspondence is addressed, indicated by asterisk after that author’s surname and inclusion of an email address in the manuscript file. The names in the manuscript file must accord with the information entered in ACS Paragon Plus.

Author Affiliation

For each author, include an institutional affiliation (department or unit and address) where the work was done. If the present affiliation of an author differs from the one at which the work was done, the new affiliation and address should be given in an author information note at the end of the manuscript file.

Abstract

The abstract should summarize the important points made in the manuscript. An abstract is most useful when it aligns well with the manuscript's content. Include the abstract text in the manuscript file; do not incorporate display elements or cited literature in the abstract. A well-written abstract aids in successful information retrieval.

Abstract Graphic

An abstract graphic provides a quick visual representation of the content and should be original work differentiated from other figures in manuscript. The abstract graphic appears in print and on the Web with links to the article; readers click the abstract graphic to access the manuscript online. Specifications that apply generally to display elements also apply to the abstract graphic; [additional guidelines for table of contents/abstract graphics are available](#).

Keywords

[JCE-specific keywords](#) should be included and should match those selected in Paragon Plus (which allows a maximum of 10 terms). At least one keyword term from each of the following categories should be chosen: Audience, Domain, Pedagogy, and Topic. Keywords help facilitate searching and abstracting and aid in discovering relevant work. Note that the keyword term "Chemical Education Research" is reserved for manuscripts that have been written and are intended for review using the [specific criteria for CER described online](#).

Main Text

Manuscript content should comport with the criteria for the manuscript type selected. Text should be presented in a single column with numbered pages, and organized using headings and subheadings (without numbers, references, or acronyms in the headings). Abbreviations and acronyms should be used sparingly and should be defined at their first occurrence.

Follow the American Chemical Society (ACS) style guidelines for formatting citations and references. ([The ACS Style Guide, 3rd ed. is freely available online](#).) Authors may wish to improve the language in their manuscript by consulting an [English Editing Service](#).

Whenever possible, use systematic nomenclature as recommended by IUPAC for chemical compounds and SI units, including in table column headings. (See the [IUPAC "color books"](#), which include nomenclature and terminology guides.) Present analyzed data in an accurate, complete, yet concise manner. Express results with indications of their reliability. This includes appropriate use of significant figures, as well as statistical parameters (e.g., standard deviation, *p*-values indicating statistical significance, and measures of effect size). Unambiguously define terms and variables and other considerations supporting claims.

Display Elements

Display elements are distinct, tangible items that can be added within the main text to support ideas in a visual, tabular, or mathematical form, including figures, tables, equations, schemes, and boxes. Numbered display elements should be sequentially numbered by type using arabic numerals, and specifically referred to in the main text. Display elements should be self-explanatory, that is, able to stand alone. [Incorporate display elements by embedding them](#) in proximity to their first mention in the main text. Assemble multipart display elements into a single object, whether a figure, scheme, box, or equation. A key line or box should not be placed around the entire object.

- **Figures** are illustrations of ideas and data, often in the form of graphs, line drawings, and photographs, among other examples. Figures can be numbered or

unnumbered (if a displayed chemical structure). Numbered figures must have captions. Provide captions in the manuscript file as text outside of the graphic object.

- **Tables** most often report data, summarize findings or outcomes, or show interrelationships of variables, parameters, or ideas. Include a brief, descriptive title that in conjunction with column headings will make cell entries clear to readers.
- Three types of **equations** are available: mathematical, text-based chemical, and graphical-based chemical. Equations may be numbered or unnumbered.
- **Schemes** are illustrations of chemical reactions that show the mechanism of action. Schemes must have titles provided in the manuscript file as text outside of the graphic object.
- **Boxes** contain all or mostly text. A box can consist of a list, example problem, text-based process scheme, or text that is not part of the main text. Boxes must have titles provided as the first line. Tables with one column are likely best presented as boxes.

Technical specifications for display elements are detailed below.

Associated Content: Supporting Information

Supporting Information is material (e.g., figures, raw data, movies, media files, lengthy tables, sample computer files, student handouts) separate from the manuscript that will be published only online. Authors must provide these materials during submission to make them available to reviewers. Supporting Information should be briefly described under an “Associated Content” section and should also be mentioned in the text discussion. No parts of the manuscript should be duplicated in the Supporting Information. Supporting Information is required for Laboratory Experiments and Activities and is optional for other manuscript types. The appropriate format is:

Supporting Information. Brief statement in nonsentence format listing the contents of the material supplied as Supporting Information.

Acknowledgment

Include acknowledgment of grant and other financial support, technical assistance, colleagues’ advice, and so on. Do not use professional titles or honorifics in this section.

References

A thorough literature review should be conducted, and the submission should be placed within the context of previously published work, including that which has appeared in *JCE*. Citations and references should comport with publication style. Unpublished work that has been cited should be uploaded for editorial review. Reference call-out numbers in the text should be superscripted sequential arabic numerals. Article titles should be included for journal references. Journal names are abbreviated according to the Chemical Abstracts Service Source Index (CASSI): <http://cassi.cas.org>. Page ranges for articles as well as book chapters should also be provided. Manuscripts accepted for publication are cited as “in press”; the DOI should be given if the manuscript is available online. Textual material that might otherwise constitute a footnote or endnote must be incorporated into the References section as complete sentences. Rather than providing URLs in the main text of the manuscript, add a citation for each discrete URL, including it sequentially in the References section with an “accessed” statement: “(accessed [Month] 20XX).” References to resources only in a language other than English will be largely inaccessible to *JCE* readers; including sufficient references to English-language resources will benefit readers and increase the value of the manuscript to the field.

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Authors are invited to submit high-resolution, attractive, relevant images for consideration for use in cover art. Images showing students (and people generally) engaged in chemistry are also encouraged. Appropriate permissions must be secured and model releases completed (see Permissions, below). Selected cover images will be used by the *JCE* Editorial Office to design the final cover art. Final decisions on cover images and design are made by the *JCE* Editorial Office.

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Display elements have technical requirements for publication. Because ACS prepares manuscripts for publication in double-column format, display elements should be included at publication size in the manuscript file, either single- or double-column width (single-column width is usually preferable to double-column width). Single-column width is 3.3 inches wide; double-column width is 6.9 inches; the maximum height for all elements is 9.1 inches, including the caption or title. Allow 12 points or 0.17 inches for each line of caption or title text. Use 8-point font size in figures, schemes, and tables; use 10-point font size for equations and boxes.

For creating display elements, use an appropriate tool: PowerPoint or an appropriate graphics program for figures; the table tool for tables; equation editor for mathematical equations; ChemDraw (a [ChemDraw template is available](#)) for schemes, structures, and chemical equations; and the textbox tool in Word for boxes.

Figures and Schemes

Some specifications relate to figures and schemes, which can be in one of two different representations: rasterized (pixels) or vectorized (lines and letters) format.

For rasterized objects, the resolution requirements depend on the color space:

- Black-and-white line art should be 1200 ppi.
- Gray-scale art (an image containing only shades of gray) should be 600 ppi.
- Color art (RGB color mode) should be 300 ppi.

Vectorized objects require an interpretation of the font information:

- Ensure that all fonts are either converted to outlines or embedded. Note that vectorized objects will be rasterized for publication.

For both rasterized and vectorized objects, adhere to these line and letter specifications:

- Line width should be no thinner than 0.5 points (4 pixels at 600 ppi).
- Dashed lines should at least 2 points in length per segment.
- The typical 8-point lettering can be modified in size to emphasize or deemphasize a label as long as the text becomes no smaller than 6 points.
- Very small incidental text or shapes that are not intended to be read or identified should be avoided.

Tables

For tables, adhere to these specifications:

- Convey additional information for cell entries by using table footnotes rather than bold or italic type for emphasis.
- Give table footnotes letter designations and position them in the bottom table row.
- To cite a resource in a table, use a table footnote and in that footnote cite the reference number corresponding to its entry in the References section.
- Present table headings and cell entries using a horizontal text direction rather than a vertical or diagonal text direction.

Equations

For chemical equations, use a representation that accommodates reaction and equilibrium arrows.

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Ensure that all Custom Questions pertaining to conflict of interest, unpublished work, and previous submission have been answered. The abstract field should be filled in. Ensure that all authors’ names are included and identical in both the manuscript and in ACS Paragon Plus.

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EDITORIAL PROCESS AND PEER REVIEW

Initial Processing

JCE editors initially evaluate each submitted manuscript to determine whether it should be sent for peer review based on meeting publication requirements and comportment with protocols. Submissions that do not comply with protocols will be returned to authors (or “unsubmitted”).

Assistance with Improving Your Manuscript

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Those manuscripts that meet the initial requirements are assigned to an associate editor (AE). The AE sends the manuscript to reviewers for them to evaluate according to the following criteria:

- Scholarship (scientific and scholarly rigor)
- Novelty (originality, innovation, creativity)
- Pedagogy (educational relevance, insight)
- Utility (usefulness to readers, rationale)
- Presentation (organization, comprehensiveness, readability)

Reviewers may recommend “Publish As Is,” request minor or major revisions, or recommend “Do Not Publish”.

Authors may suggest reviewers and are encouraged to designate preferred reviewers within ACS Paragon Plus; these reviewers’ names will be added to the unranked list of suggested reviewers for the submission. Editors may choose to invite any, all, or none of the suggested reviewers to evaluate the submission. Including suggested reviewers assists the *Journal* in expanding its reviewer pool. (Please consider the [ACS Ethical Guidelines](#) before selecting reviewers with a potential conflict of interest.)

Once reviewers make their dispositions, the AE evaluates their arguments and makes a decision whether to accept the manuscript. The AE adjudicates based on the reviewer comments; however, the reviews are not to be considered “votes”, and the review process is not one of “majority rules”. Very few manuscripts are published as

originally submitted; nearly all are recommended for revision and are improved in response to reviewer suggestions before being accepted and published.

Because of the many submissions the *Journal* receives—and because manuscripts are unique and require varying levels of attention—definitive processing times cannot be guaranteed. Authors are notified once their manuscripts proceed to the next stage.

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TYPES OF DECISIONS

Decision types include revision, reject and resubmit, reject, and accept. Decisions are based on reviews and assessments made by the editorial office.

Revision

The editor-in-chief (EIC) or associate editor may request a minor or major revision at any point during the peer-review process. A thorough cover letter acknowledging the revision and a document containing itemized responses to reviewer comments must accompany the revision. Previous manuscript identification numbers should be referenced. Ensure that the latest files have been uploaded and that there are no extraneous files.

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Rejection

The EIC or AE may reject a manuscript with editorial or external peer review at any point during the peer-review process after determining that the submission is not within the remit of the *Journal*.

Accept

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