

ACKNOWLEDGMENTS

The authors would like to acknowledge the help of Minqui Lu and Jeff Smith for their valuable suggestions during the development of the experiments, and Rocky Chen and Andrea Hailey for providing the data on the extruder experiment.

REFERENCES

1. Crawford, R.J., *Plastics Engineering*, 2nd ed., Pergamon Press, New York, NY (1987)
2. Progelhof, Richard C., and James L. Throne, *Polymer Engineering Principles: Properties, Processes, Tests for Design*, Hansen Publishers, New York (1993); McCrum, N.G., C.P. Buckley, and C.B. Bucknall, *Principles of Polymer Engineering*, Oxford University Press, Oxford, UK (1988)
3. Brandrup, J., and E.H. Immergut, *Polymer Handbook*, 3rd ed., Wiley Interscience, New York (1989)
4. Bird, B.R., R.C. Armstrong, and O. Hassagar, *Dynamics of Polymeric Fluids*, 2nd ed., Vol. I, Wiley-Interscience, New York (1987)
5. Bird, R.B., W.E. Stewart, and E.N. Lightfoot, *Transport Phenomena*, Wiley-International Edition (1960) □

ChE book review

THE COMPLEAT CHEMICAL ENGINEER: A Guide to Critical Thinking

by Robert B. Barat, Norbert Elliott

Kendall/Hunt Publishing Company, 111 Purina Drive, Dubuque, IA 52001 (1993)

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The main focus of this book is to improve critical thinking and communication skills, especially in the context of the senior laboratory. The book is founded on the four principles that the authors describe in an essay for instructors: take an interdisciplinary view, think critically, learn to communicate effectively, and consider the impact of technology on society.

The authors produce a framework for introducing and integrating these principles. The model that they use is one of seeing the situation from four different points of view— independent thought, intellectual breadth, cultural breadth, and ethical awareness. They illustrate their application of the model to the process of solving a mass and energy balance, designing a process, and performing a laboratory experiment. The seven-step strategy for doing the laboratory (plan, execute, convert and integrate data, look for patterns, reflect on the quality of the results, argue your results and conclusions, and translate) is well illustrated by excerpts

from various laboratory experiments. Although this is a broad framework for thinking critically, few details are given about how to actually do it. The premise is good; the details are missing.

The topics address in the various chapters are:

Chapter 2, Interpreting the History of Chemical Engineering, introduces the heuristic of “particle, wave, field” and asks us to apply these different viewpoints to a study of the several historical decisions important to chemical engineers.

Chapter 3, Working in the Laboratory, describes the purpose of experimentation, provides an 11-step strategy, lists the usual safety regulations, gives seven very good guidelines for experimenting (*e.g.*, penetrate the heart of the experiment), gives checklists to troubleshoot experiments, discusses collaborative work, and provides assessment checklists. On the assessment forms that are given, I would have liked to have seen the criteria given explicitly as well as some items that assess critical thinking.

Chapter 4 on The Uses of Argument in Chemical Engineering focuses more on error bars than on evidence, claims, and qualifications. I would have liked more on the latter.

Chapter 5, Conducting the Literature Search, describes the usual resources and strategies.

Chapter 6 on Ethics, gives a good but brief overview. Some of the professional engineering association’s Codes of Ethics could have been given and applied to different cases. The authors’ tendency was to encourage the reader to create his or her own code.

Chapter 7, Planning the Laboratory Environment, An Architectural View, discusses the layout of a lab.

Engineers and the Environment, Chapter 8, uses a case study to briefly illustrate the principles.

Communicating Information in Chemical Engineering, Chapter 9, outlines the principles of writing to the audience, and Chapter 10 describes the formats to use for different types of reports and lecture notes. Chapter 11 illustrates how to write lab reports and has a rich set of examples. The marking of the communication is given. I would like to have seen more assessment of critical thinking.

The last part of the book, “An Essay for Instructors,” provides excellent suggestions about how to use the topics and assignments in a variety of courses. The problems at the end of each chapter are imaginative and illustrate the four principles upon which the text is based. Some basic feedback forms are given; no index is given.

The book introduces a starting framework for independence, breadth of viewpoint, and ethics. I wish there was more explicit development of the themes. The book gives a convenient collection of material on how to work in the laboratory and how to write laboratory reports, but little is given to develop critical thinking. □