fixed-bed adsorption. Combustion calculations are then reviewed and extended to the complex systems encountered in stack or exhaust gases containing oxides of sulfur and oxides of nitrogen. The role of the thermodynamics and kinetics of the reactions involved in the formation of these pollutants is explored. Special effects relating to the psychrometry of these stack gases are also presented. Finally, we examine specific control methods which are now being developed for certain gases.

At various appropriate points in the course the basic concepts of system and equipment design optimization are introduced and applied to the air pollution control system. Generalizations relating to costs and economic aspects of control systems are likewise brought in. It would be desirable to give a more thorough treatment of these matters. This is one motivation for lengthening the course to three quarters. It would also be desirable to present computer simulation of control devices.

The method of instruction involves asking the students to solve a number of problems specially devised for the course. Some of these are numerical illustrations of the use of the models or design methods. Others, however, are open-ended design problems in which judgment and ingenuity may be exercised and alternative solutions considered. The effect of a particular system parameter is illustrated by having different members of the class do the same calculation with each using a different value of the specified parameter, and then pooling the results into one overall picture.

There really is no text which is quite appropriate for this course as it is now conceived. The one used thus far has been "Industrial Gas Cleaning" by Strauss (Pergamon, 1966). Material has also been drawn from Stern's "Air Pollution", especially Vol. III of the 2nd edition (Academic Press, 1968). Much use is made also of original literature references. There is a lot of interest in these problems today, and new work is appearing with increasing frequency.

It is hoped that chemical engineering students will find increasing interest in dealing with air pollution problems, especially through the approach taken by such a course as this. Many of the concepts which are familiar to them in reactor design and in transport phenomena, can be transferred immediately with very fruitful results. Every effort is made to show them, and all students, that the pollution problem is not only serious enough to demand their attention as concerned citizens, but also challenging and sophisticated enough to captivate their intellectual interest at the highest level of professional competence. This applies not only to the present, but certainly even more so to the future developments in research and design.

ChE problems for teachers

Submitted by Professor R. M. Felder, North Carolina State University at Raleigh.

A graduate student in your seminar on existential reaction engineering bursts into your office, barely giving you time to cover Playboy with Chemical Engineering Progress, and announces that he has formulated a proof of man's nonexistence based on the known effects of diffusion in tubular reactors. All thoughts of the Playmate of the Month are forgotten as visions of publications, promotions, awards and enduring fame dance in your head. (You would, of course, acknowledge helpful discussions with the student in a footnote somewhere.) You casually express an interest, and the student promptly erases the irreplaceable notes on your blackboard and offers the following demonstration:

Consider a laminar flow tubular reactor in which a single first-order reaction occurs. Now

1. Radial diffusion brings the reactor closer to plug flow, and therefore increases conversion. On the other hand
2. Axial diffusion brings the reactor closer to a stirred tank, and therefore decreases conversion. But
3. Radial diffusion can be represented as axial diffusion using the Taylor model. Therefore
4. Radial diffusion both increases conversion [from (1)] and decreases conversion [from (2) and (3)]. The only way this can be the case, however, is if
5. Radial diffusion does not affect conversion at all. But we all know that it does, and consequently
6. Radial diffusion does not exist. Moreover, by applying a coorrdinate transformation which maps the radius onto the axis and vice versa, it can easily be shown that axial diffusion also does not exist. In short,
7. There is no such thing as diffusion in tubular reactors. But everyone knows there is, and therefore
8. Tubular reactors do not exist. But I am certain beyond all possible doubt that tubular reactors exist, which can only mean that
9. I do not exist. Q.E.D.

Sadly, you realize that you might just as well have kept your thoughts on Miss October, and that any enduring fame you get will have to come from your process to manufacture sand from glass (patent applied for). Meanwhile it's almost time for lunch, so you decide to ignore the student's philosophical fallacies and simply advise him where his engineering analysis [Steps 1-4] falls down. What do you tell him?