Preface

This solutions guide accompanies the second edition of the text. For the instructor, this manual should help clarify concepts and principles as applied in the homework. For the student, this manual should be ***the last book opened***. Why? In my experience, students tend to use the solutions manual in a less than optimal way. For example, here is the wrong way to use a solutions manual:

1. Obtain the assigned homework from the instructor.
2. Open the solutions manual and copy the results for each problem, cleverly altering them so that it does not appear that you in fact used the solutions manual.[*]
3. Quit.
4. When test time comes around, study the solutions manual and hope to survive.

This is not learning; this is jockeying to do well on a test. Now, here is the correct way to use the solutions manual:

1. Obtain the assignment, also doing extra problems that are similar to those assigned.
2. Work the problem, making sure to reinforce concepts as you go. For example, if the problem involves an acid/base extraction, refer back to that section of the text and refresh your memory.
3. Check and honestly critique your work; focus on "honestly."
4. Do the next problem.
5. When finished with the assignment and related problems, open the solutions manual.
6. Check your work.
7. Close the solutions manual and put it far away from you.
8. Redo the problems you missed.
9. Return to step 4 and repeat.
10. When test time comes, you are ready.

[*] FYI, you are kidding yourself if you think this works.

Notes:

Frequent mention is made of the following references; they are abbreviated within:

"Clarke's Handbook" refers to:

Galichet, L. Y., et al., ed. *Clarke's Analysis of Drugs and Poisons,* Vol 1. and Vol. 2 London: Pharmaceutical Press, 2004. (Volume 2 contains monograms on the individual drugs and is referenced most frequently.)

PDR refers to:

Physicians' Desk Reference, 58th ed. Montvale, NJ: Thomson PDR, 2004.

Physicians' Desk Reference for Nonprescription Drugs and Dietary Supplements, 22nd ed. Montvale, NJ: Medical Economics—Thomson Healthcare, 2001.

CRC Handbook refers to:

Handbook of Chemistry and Physics, 84th ed. Boca Raton, FL: CRC Press, 2003–2004.

Merck refers to:

O'Neil, M. J., et al., ed. *The Merck Index: An Encyclopedia of Chemicals, Drugs, and Biologicals*. Whitehouse Station, NJ: Merck Research Laboratories—Merck and Co., 2001.

For illustrative purposes and in spreadsheet printouts, extra significant digits may appear in intermediate calculations. This is to avoid rounding errors and make the process and procedure used clear.

Errata: The solutions manual was completed after the first printing of the book went to press. Errors in the questions that were found are noted in the solutions manual and corrections applied; subsequent printings will have the corrections applied.

Introduction

CHAPTER

1

From the chapter

1. Compare and contrast the adversarial system and the scientific method. List the strengths and weaknesses of both in the context of criminal and civil law.

The scientific method is based on experiment and observation, postulations of relationships, iterative testing, and drawing conclusions based on the results. The adversarial system is based on arguments from opposing parties. The scientific method does not by design pit one side against another. Certainly, there are arguments in science, but the arguments are resolved by experiment and observation. The process may take decades, but if the data is consistent and reproducible, conclusions are drawn and consensus is reached. Adversaries argue based on differing viewpoints, interpretations, and agendas. Science can be used to support or refute interpretations of events and evidence, but the outcome depends on the strength of the argument and the skill of those making it.

The adversarial system is well-suited to situations in which social and human (for lack of a better term) issues are involved. A person may have committed murder, but the reasons and circumstances are critical to the deliberation. Science, on the other hand, seeks to elucidate natural laws and to apply them to derive new knowledge. Ideally, there is no social element; gravity does not take into account mitigating circumstances, for example. This process is essential for understanding the laws of the universe since consistency and reproducibility are required to derive them. It is not an ideal system for dealing with human beings.

2. During a *Daubert* hearing, what entity ultimately decides on admissibility?

The judge, who acts as the gatekeeper.

3. What role does peer review play in science and in the law? Compare and contrast.

Argument before a judge, jury, or lawyers is loosely analogous to peer review. The appeals process could also be placed in the category since professionals of the law review the work done by other professionals. Peer review is more obvious and central in science where it is an integral part of the dissemination process. Scientific findings are submitted to peer-reviewed journals where editors assign qualified reviewers to comment on and judge the work. They may accept it as is, request more information or work, or recommend that it not be published. Publication in a peer-reviewed journal is validation of acceptance by those with similar skills, background, and understanding of the mechanism of science; materials published in non-peer-reviewed journals or sources generally are not given the same weight or credibility as peer-reviewed data.

4. Describe how a preponderance of inclusive circumstantial evidence can become conclusive in the eyes of a jury.

The Wayne Williams case is the perfect example of this phenomenon. Had a few dog hairs been found on victims, such a finding would place under suspicion only those people who owned or might have come in contact with dogs, a large percentage of the population. It was the unique combination of hairs and fibers that was compelling. Consider your own home. What types of hairs and fibers would be found there? How would that compare with a friend's environment? You might both have the same blue carpet if you live in the same apartment building or dorm, but the hairs to be found in your two rooms would be different, as would fibers from clothing and articles of furniture. Link enough of such observations together and it becomes clear that your apartment is a much different environment than even one next door.

Integrative

1. A great scientist can still be a terrible forensic scientist; a person who gives wonderful testimony can be a terrible forensic scientist. Comment on these observations and the implication for forensic chemistry.

Forensic science and forensic chemistry require understanding and skills in comparison. It is not always an easy skill to acquire nor is the forensic mindset necessarily a natural one. In addition, a

forensic scientist must be able to apply advanced techniques and knowledge to the analysis of evidence, yet present the results clearly and concisely to an audience without a comparable body of knowledge or experience. Thus, forensic scientists must be good communicators and good teachers. A great research scientist might be able to communicate with peers, but may struggle to distill the complexities of his or her work such that anyone with a high school education could grasp the concepts. Conversely, a person may be able to concisely and brilliantly present findings that are completely wrong; the skill of the presentation coupled with the audience's lack of background can result in acceptance of incorrect information. A forensic chemist must be the master of the chemistry and of the forensic aspects—to speak the truth (derived from science) in the public forum.

2. Can jurors ask questions of expert witnesses? Comment on your findings regarding this issue.

Except under rare circumstances, they cannot. They also are not usually allowed to take notes; however, practices are changing in some states. For example, in Arizona, jurors may submit questions for expert witnesses to the judge, who screens the questions and then will ask those that are probative and appropriate. In some cases, jurors are also allowed to take notes and to take these notes into deliberation.

How jurors interact with expert witnesses and how scientific evidence is presented is becoming an increasingly difficult issue, given the complexity of scientific testimony. Complicating this issue is the general lack of scientific background in jurors, judges, and lawyers. It is hard to imagine reforms not occurring as the complexity of testimony continually increases.

Food for thought

1. Is the analysis of drugs using instruments such as mass spectrometers and infrared spectrometry based on comparison?

Arguably yes. Identifications are made by comparing data to that stored in a library.

2. How important is the way in which scientific evidence is presented? Comment on the relative importance of content versus presentation. Why is learning how to testify such an important skill?

See Integrative question #1 above. A forensic scientist must be able to communicate findings concisely and clearly to the court so the trier-of-fact can properly weigh the information. Poorly communicated evidence can be as damaging as poor scientific practice.

