Among miscellaneous experiments with magnets:

I. What Happens When You Break a Magnet?

A thin bar or knitting needle is notched with a hacksaw or a file. The whole rod is magnetized and its polarity tested and marked. It is then broken in halves.

[*Sketches*]

5. Why is it best to notch the bar before you magnetized it?
6. Suppose you broke a magnetized rod and found the poles adjacent to the break *both* N or *both* S. What would you have found if you had tested the bar before breaking it? How would you make such a magnet?

II. Which is the Magnet?

Take two *identical* iron rods. They look alike, they feel alike, they weigh alike. Magnetize ONE. *Without any accessories* whatsoever it is required to determine which is the magnet.

4. An array of bar magnets is placed at random on a board which floats in water in a wooden tub. Conjecture on what will happen.

On elasticity, after hammering a lead block and noting the warming:

2. What metal would show the greatest response in this experiment?
4. Do raindrops warm up or cool as they fall? How about when they land?

Bend a paper clip back and forth in the fingers a number of times.

[*Sketch*]

1. What happens and why?
2. Of various samples of wire (say 2 or 3 inches long) which would show the highest temperature change in a dozen bends, say? *How* are you thinking this out? That is, what questions are you asking?
3. A gas is contained compressed in a small bottle. This small bottle resides in a large evacuated bottle. The small bottle is broken. Its gas flies out. What happens to its temperature?

The experiments with their questions continue through electricity to some on atomic physics. Here and there the author adds a comment with emotion (which I welcome in teaching because it is the way in which an artist opens our eyes) such as this, in experiments on crystals, "The effects are extraordinarily beautiful, as the crystals grow."

So here is a chance to pick the brains of a physicist and teacher with special skills and long experience. I would say, to anyone who is teaching students to think as they learn physics, "Buy this book and enjoy the questions. For my part I am still enjoying worrying over some of them. Thank you, Professor Miller."

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Pion-Nucleon Scattering

By R. J. Cence
138 pp. Princeton U. P., Princeton, N. J., 1969. $6.50

In recent years, high-energy physicists have devoted an extraordinary amount of attention to the problem of the scattering of pions by nucleons. The reason for this is that pion–nucleon scattering appears to be one of the simplest processes that shed light on the still elusive nature of the strong interactions.

Robert Cence, who has contributed in a substantial way to the experimental knowledge of pion–nucleon scattering, has written a good book for advanced graduate students and beginning research workers in the field. This is a small and, therefore, incomplete book. Cence's choice of subjects reflects in a large part his own interests. Thus, although he discusses experimental scattering data up to 20 GeV incident pion energy, he focuses much of his attention on the data below 2 GeV.

Cence discusses the various kinds of experiments that are usually performed, including measurements of total collision cross sections, cross sections for elastic scattering, differential cross sections, polarization and the so-called "rotation parameters." He also briefly considers pion-production experiments induced either by photons or by pions incident on nucleons.

The theoretical description of pion-nucleon elastic scattering can be given in terms of two complex amplitudes. Cence chooses these to be the spin-nonflip amplitude, in which the nucleon spin keeps its original orientation during the scattering, and the spin-flip amplitude, in which the orientation of the spin is changed. Cence devotes considerable attention to the partial-wave decomposition of these two amplitudes. He also discusses how the measured quantities, such as cross sections and polarizations, are related to them. This is valuable information for both theorists and experimentalists. However, the theorist must also be able to describe the scattering in terms of either helicity amplitudes or invariant amplitudes and needs to know the relations among the various sets. He also needs to know the crossing symmetry properties of the amplitudes. This information he will not find in Cence's book.

The author devotes a short space to the discussion of phenomenological models, which aid physicists in interpreting the data. Again the phenomena at low and intermediate energies are given a more thorough treatment than those at high energy. For example, there is only a brief discussion of the Regge-pole model, which has been used extensively in recent years to describe the high-energy data in an approximate way. Somewhat perversely for a book that emphasizes low energy, there is some discussion of the Pomeranchuk theorem, which says the π^+-proton and π^--proton total cross sections become equal as the energy becomes infinite. We are very far from testing this theorem experimentally, as the 70-GeV data from Serpukhov (too recent to be included in this book) make abundantly clear.

I have some minor criticisms. For example, the author says that the charge-exchange reaction $\pi^- p \rightarrow \pi^0 n$ is loosely referred to as an elastic process because it contains only two particles in the final state. This is not the reason, as otherwise photoproduction would be loosely called elastic. The actual reason is that, in the isospin formalism, pions with different charges are considered as merely different states of the same particle.

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Thin-Film Transistors

By Andrew C. Tickle
144 pp. Wiley, New York, 1969. $9.95

Applied Solid State Science, Vol. 1: Advances in Applied Solid State Physics

Raymond Wolfe, ***ed.***
404 pp. Academic, New York, 1969. $15.00

These two books have a slightly different approach to the same field of technology.

Thin-Film Transistors is an introductory text describing the theory and practice of transistors fabricated by thin-film deposition techniques. The author, Andrew C. Tickle, is at the applied research laboratory of Litton Systems and is former head of materials and devices laboratory, College of Engineering, University of Saskatchewan, Canada. Although the main emphasis is on transistors, integrated circuits fabricated in the same fashion are also treated. The text covers device theory, methods of fabrication and analysis and circuit tech-