fold and six-fold coordination, except that the critical ionicity is now $f_i' = 0.886$. Values of ionicity can be recalculated from all of Phillips's f_i values. The new numbers are all higher than before, but still appear reasonable.

There is no reason, of course, why both f_i' and f_i cannot be true scales, since they are simply related to each other. Consider, however, the intuitive meaning of ionicity, (agreed to by Phillips as well) as the fraction of time spent by the valence electrons in the configuration A^+B^-, as compared to A:B. This meaning is much more closely related to f_i' than to f_i. This suggests that a better scale of ionicity is given by

$$f_i' = C/(E_h^2 + C^2)^{1/2} \qquad (5)$$

than by equation 1.

Ralph G. Pearson
Northwestern University
Evanston, Illinois

The author comments: Pearson's points are well taken. Because of space considerations, my article in *physics today* could not explore analogies with standard chemical theories, such as the Hückel theory or the Coulson valence-bond theory. In a much longer article [Rev. Mod. Phys. **42**, 317–356 (1970)] some of these analogies are examined quantitatively, especially those following from Pearson's equation 2, and I hope that this article will show that I was aware of these analogies.

Following Coulson in section 3 of the longer article I was able to evaluate $(1 - \lambda^2)/(1 + \lambda^2)$ in Pearson's equation 4, but I obtained a different result than he does. This is because Coulson used Moffit's method to treat charging effects self-consistently. When this is done, one finds that $(1 - \lambda^2)/(1 + \lambda^2)$ is just equal to $1 - N/4$ to lowest order for any A^NB^{8-N} compound, *independent* of A and B. This approach would predict that all II–VI compounds have nearly the same ionicity, and thus could not be used to predict which II–VI compounds (such as MgO) have the rock-salt structure, and which (like ZnO) have covalent, four-fold coordinated structures.

The path that I have taken follows Pauling much more closely than it does Coulson, and places greater emphasis on observable quantities like heats of formation and interatomic forces than it does on charge exchange. The latter is important for molecular reactions, but it is less useful in discussing crystalline properties. I have preferred to avoid it, rather than introduce an additional arbitrary element into the theory.

J. C. Phillips
Bell Telephone Laboratories
Murray Hill, N. J.

More on job picture

In the May issue, (page 23) Murray Gell-Mann observes that "science and technology are being underutilized in a wide variety of immediate civilian tasks of great social importance. . ." He then concludes the paragraph with: "I think, as long as these jobs are being neglected, we cannot speak of any overproduction of scientists and engineers."

It is not entirely clear from the context whether it is the scientists and engineers or those who employ them that are neglecting these jobs. If it is the former group and Gell-Mann has some as yet unpublished list of employers who are quietly seeking scientists and engineers to "employ humane rationality," then I certainly would appreciate a preprint. However, if it is the employers who are neglecting these jobs, then I find it absolutely incredible that his conclusion directly follows a sentence containing the expression "humane rationality."

In the latter case, I suggest that the physics community would do well to take Gell-Mann's advice and apply humane rationality to its own employment crisis. Even physicists are subject to the economic laws of supply and demand. During the years of shortages of physicists, the physics community responded magnificently by increasing supply to meet demand, closing the "critical gap" in ten years or less. Now in years of surplus we hear many physicists talking of somehow increasing demand to meet supply. Yet, none has come forth with an effective way of *making* an employer hire a physicist. The physics community is not the first segment of our economy to discover that it holds considerable influence on supply but almost none on demand.

Frank D. Feiock
San Diego, California

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Since my letter appeared in March (page 9) I have unwittingly become a storm center in the current controversy, and I ask this opportunity to defend myself. I have received well over 200 letters since March. About 80% of them were from unemployed physicists who felt that I could help them find employment. To them I regretfully say that I am sympathetic but not a miracle worker. I cannot help you.

Most of the remaining letters were from certain people in industry and the academic community who, I presume, have a vested interest in maintaining present PhD production. Many of these letters attacked me personally and some even called for my resignation.

There were generally two categories of errors in these letters. The first type consisted of elaborating a particular case of a physicist who successfully

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letters

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switched fields, with the implicit assumption that if he could do it, most other unemployed physicists could do the same. This is nonsense. The positions quoted were essentially "one of a kind" type of jobs. I believe that your community is already finding that organized attempts to find jobs for physicists in other fields have statistically been failures. You of course will always find a few jobs in other fields but not in the numbers needed for your present rate of PhD production.

The second category of error is more serious. It is an assumption that somehow production of physics PhD's is above the law of supply and demand. You people must know what is happening in the university and college market, so I'll limit my remarks to industrial employment.

It may surprise you to learn that the new PhD was not the hardest hit. The people worst off were those in private industry, over 37 years of age, with a salary between $15 000 and $20 000. When a physicist has worked for several years for a company and has reached the point where he has a higher salary and the company's contribution to his retirement plan is significant, he is dismissed and replaced by a younger physicist who will work for much less. This same pattern, although not as severe, has existed in the aerospace industry for the last ten years and is now firmly established for industrial physicists. It is strictly a matter of supply and demand. Because of this pattern, the average professional lifetime of a physics PhD in industry has become somewhere between six and seven years.

A physicist, no matter what his credentials, is generally no longer considered by employers if he is over 37 years of age. Likewise, a physicist who has been unemployed for more than eight or nine months will not be considered for employment. Again, it's simply a matter of supply and demand.

I don't claim that these "rules of the game" are logical; only that they are firmly established and followed. The most employable of the unemployable are about 30 years of age, with between one and two years of industrial experience (no more and no less) and a salary in the low teens.

The very employment mechanism for the research physicist is now breaking down. By and large, employment is no longer routine. A particular scientist's background must fit precisely an employer's requirements to an unbelievable degree of specialization. Generally his employment must be approved by a host of executive vice-presidents. Employment has reached the point where it's strictly on an individual basis, generally through personal contacts rather than employment agencies, and must be approved by top management!

Finally, I'd like to discuss the several meanings of the term "overqualified" which employers in non-traditional employment areas use when rejecting PhD's. It is partly a matter of salary. These employers have no intention of paying a higher salary, and so they reject the PhD. They also feel that the job can be done adequately by someone with much less training, and they are generally right; employers are practical or they would soon go out of business. They also question the PhD's ability to get along with laymen, which is a very important consideration. Astonishingly, the physicist's very reputation of being high-powered hurts him. No immediate superior will hire a man whom he feels can do his own (the superior's) job with ease.

Let me now defend my original position. You people will not change employers' attitudes in much less than a decade, if ever. You have potential control over one variable only—PhD production. Fortunately, the effect of this variable far outweighs the effect of all others combined. If physicists, whom I consider to be among the smartest individuals in the country, cannot control their own numbers now that it's necessary to do so, then I hate to think of the outcome of the world overpopulation problem.

I predict that your time available for such control is limited. The only condition that will continue to attract sufficient numbers of students in the long run is the assurance that production is being sufficiently curtailed so that they can survive, after obtaining their doctorates.

The information I have presented above is factual. There is no point arguing its validity. I may be the harbinger of bad news but not its creator. So please, gentlemen, no more vitriolic letters.

Stuart A. Silverman
Allan & Speth of Buffalo
Amherst, N.Y.

NSF survey

In your May issue (page 64) you exhort our colleagues to respond promptly to NSF's thoughtful and well-meant attempt to assess the scope of the economic catastrophe via a post-card survey. Unfortunately, they will only find out how bad it has *been*, not how bad it is *going* to be: they neglected to ask whether the respondent had a job for the *next* academic year, and how long he had been looking for *that*.

Ronald Blum
University of Maryland
College Park □