theoretical studies by Powell and Eyring[1] and Gee,[2] that liquid sulfur contains chain-type polymers. The point of view adopted by Krebs[3] that large rings are the primary type of polymeric material is probably incorrect.

The sulfur was purified by the method of Bacon and Fanelli,[4] but after being subjected to repeated cycles of heating and cooling until the elapsed time of heating approached about 30 hours, a few black particles were observed in the sample, and the width of the resonance line had increased by about a factor of two. In addition, the sample showed a very weak paramagnetic absorption at room temperature whereas no absorption had been detected at room temperature before the extended period of heating. It is evident that greater care must be taken to insure a high degree of purity, and therefore our present results cannot be relied on for quantitative validity.

Our measurements[5] were made on sulfur which had been degassed by 15 cycles of melting and freezing under vacuum (about 10^{-3} mm.). The concentration of radicals was found to increase by a factor of from 100 to 200 in the range from 190 to 375°; the absolute value of the intensity corresponds to a radical concentration of the order of 10^{-5} mole/l. at 200°. The value of ΔH for breaking a S–S bond in a long chain that is derived from these data is consistent with the value obtained by Gee[2] from the viscosity data of Bacon and Fanelli,[5] and the observed radical concentration at 200° corresponds in order of magnitude to that estimated by Gee. The width of the resonance line is about 15 gauss at 190° and appears to increase to about 35 gauss at 375°. The spectroscopic splitting factor (g-value) is 2.02.

Bacon and Fanelli[6] reported that several varieties of C.P. sulfur were blackened after they were subjected to boiling for 2–3 minutes over a free-flame. We have found that N. F. sublimed sulfur flowers supplied by the Amend Drug Co. yields black particles after even less severe heat treatment. These black particles are paramagnetic at room temperature; the line width is about 20 gauss and the g-value is 2.01. It should be emphasized that in the absence of black particles the observed intensity of paramagnetic absorption was reversible with temperature and paramagnetism was not detected below about 190°.

Precise measurements will require not only more highly purified sulfur than has been used, but also a reliable standard of paramagnetic intensity usable over the entire temperature range. In addition to the value of ΔH for a S–S bond, such measurements can be used with data like that of Hammick, *et al.*,[7] for the weight fraction of polymer to obtain the degree of polymerization as a function of temperature. Present limitations on sensitivity preclude measurements at temperatures much lower than 190°.

(1) R. E. Powell and H. Eyring, THIS JOURNAL, **65**, 648 (1943).
(2) G. Gee, *Trans. Faraday Soc.*, **48**, 515 (1952).
(3) H. Krebs, *Angew. Chem.*, **65**, 293 (1953).
(4) R. F. Bacon and R. Fanelli, THIS JOURNAL, **65**, 639 (1943).
(5) A preliminary account of our instrument, which employs a type 2K25 Klystron at a wave length of 3.2 cm., has been published: J. M. Hirshon, R. L. White and G. K. Fraenkel, *Rev. Sci. Instr.*, **23**, 772 (1952). A detailed account has been submitted for publication by J. M. Hirshon and G. K. Fraenkel to *Rev. Sci. Instr.*
(6) R. F. Bacon and R. Fanelli, *Ind. Eng. Chem.*, **34**, 1043 (1942).
(7) D. L. Hammick, W. Cousins and E. Langford, *J. Chem. Soc.*, 797 (1928).

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RECEIVED OCTOBER 20, 1954

NEW SODIUM PHOSPHATES

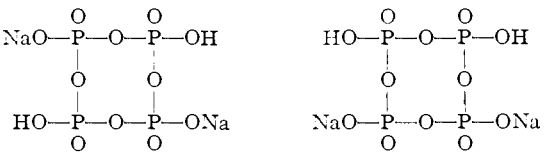
Sir:

A new series of sodium hydrogen phosphates has been discovered and two new compounds have been isolated. At 300° and above, monosodium orthophosphate reacts with orthophosphoric acid to yield sodium acid metaphosphate melts and when the melts are slowly cooled crystalline acid metaphosphates are formed. The crystallization is hastened if the melt is stirred for two or three minutes after the sample reaches the required composition.

A tetrametaphosphate results from the reaction:

$$2NaH_2PO_4 + 2H_3PO_4 \xrightarrow{400\ °C.} Na_2H_2(PO_3)_4 + 4H_2O$$

The crystalline acid metaphosphate has a unique X-ray pattern, it melts near 400° and has one of two alternate structures



A second reaction

$$2NaH_2PO_4 + H_3PO_4 \xrightarrow{300\ °C.} [Na_2H(PO_3)_3]_n + 3H_2O$$

yields a compound, the crystals of which are fibrous. The disodium monohydrogen acid metaphosphate also has a unique X-ray pattern and melts near 420°. The structure of this compound is not yet known but indications are that it is a long chain compound (polyphosphate). The reactions involving other ratios of monosodium orthophosphate to orthophosphoric acid also yield acid metaphosphates but are more difficult to isolate in a pure condition than those mentioned above.

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THE LINKAGE OF GLUCOSE IN COLIPHAGE NUCLEIC ACIDS[1]

Sir:

Independent reports[2,3] of two unusual properties of the deoxyribonucleic acids (DNA) of the related T6 and T4 coliphages led to the present investigation. The inability of pancreatic deoxyribonuclease (DNase) and intestinal phosphatase to hydrolyze T6 DNA to a reasonable quantity of hydroxy-

(1) Work performed under Contract No. W-7405-eng-26 for the Atomic Energy Commission.
(2) S. S. Cohen, *Symp. Quant. Biol.*, **18**, 221 (1953).
(3) M. Jesaitis and W. F. Goebel, *ibid.*, **18**, 205 (1953).