I cannot accept the objection by Mr. Laws to my temperature scale, as in using the MKS system any relationship to water is now irrelevant, because the kilogram mass is defined as a platinum–iridium cylinder deposited at the International Bureau of Weights and Measurements at Sèvres, France. The unit of energy is not based on the properties of water but is defined as one Newton-meter equals one Joule. Hence, all forms of energy will have the same unit, be it heat, mechanical, electrical, chemical, or atomic energy.

The purpose of my temperature scale is to base the scale on the MKS system and, thereby, eliminate the conversion factor R, in the same manner as the conversion factors J and g_c have been eliminated in the MKS system.

The proposal of Mr. Laws of adopting a temperature scale in order to preserve the tabulated numbers of c_p is unnecessary as these values can be readily converted to the MKS system from presently tabulated values in absolute molal units. For example, the National Bureau of Standards has tabulated thermal properties of gases in its *Circular* 564 (ref. 6) in dimensionless molal values. Using the MKS temperature scale, it can easily be seen that the ideal gas relation between specific heat at constant pressure and volume becomes:

$$c_p - c_v = \frac{1}{M} \tag{1}$$

where the usual gas constant R is replaced by $1/M$. The specific heat at constant pressure then becomes:

$$c_p = \left(\frac{\gamma}{\gamma - 1}\right)\frac{1}{M} \tag{2}$$

and at constant volume:

$$c_v = \left(\frac{1}{\gamma - 1}\right)\frac{1}{M} \tag{3}$$

The specific heats of gases can be readily determined by dividing the molal values by the molecular mass number M (molecular weight). I submit the following short table of specific heats at constant pressure for use with the MKS system of units and temperature scale.

Gas	Specific heat c_p at 1 atmosphere and $241 \cdot 11 \times 10^4$ J/kmole temperature (290° K)
Air	0·1210
Argon	0·0627
Hydrogen	1·717
Nitrogen	0·1252
Oxygen	0·1105
Steam	0·2405 ($\gamma = 1 \cdot 3$)
Carbon dioxide	0·1014
Carbon monoxide	0·1253

If other properties of fluids are required it is possible to re-calculate the properties of fluids very rapidly with the digital computer by substituting the proper coefficients in the appropriate equations.

I have, since writing the original proposal[1], had a series of thermometers manufactured using Joules per kilomole as a scale; and I am now using them in the laboratory and requiring students to become familiar with them. There was only a nominal surcharge for making these thermometers, and with wide adoption of the scale the price of the thermometers would be the same as present centigrade or Fahrenheit thermometers.

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Gauge Co-ordinate Group of Physical Theory

RECENTLY, a characterization of the larger exceptional Lie groups has been obtained which throws considerable light on what their role may be in physical theory[1]. They are, namely, automorphisms of Clifford algebras of the special form $\Gamma^{(m,n)} = Q_m \times Q_n$; that is, tensor products of normed division algebras Q_n of $2^n \leqslant 8$ elements. If $m = 3$, the groups are F_4, E_6, E_7, E_8 for $n = 0, 1, 2, 3$.

The Dirac algebra is $\Gamma^{(2,2)}$ restricted by reality conditions so that its group is D_3, the rotation group of six dimensions, isomorphic to the conformal group of space-time which leaves invariant Maxwell's equations. The way this algebra appears in Dirac's equation (that is, $\Gamma^\mu = \{\rho_1\sigma_i, 1, \rho_3\}$, with σ_i, ρ_i imaginary quaternions) causes the splitting:

$$D_3 \sim D_2 + A_1 \tag{1}$$

into the Lorentz group and the gauge group of isotopic spin.

The theory of strong interactions[2] has required the enlargement of the gauge group to A_2, and more recently[3] to A_5. In the latter case, then, we might expect a role for E_8 with the approximate splitting:

$$E_8 \sim B_3 + A_5 \tag{2}$$

B_3 is the group of the sphere S_7 which is unique in possessing a triality principle. Elsewhere[4] I have given some reasons for believing that it is the group of a classical phase space. It is essential for this interpretation that it involves a cosmological model, that is, at least one of the invariants of the group has a cosmological significance. Without this feature a splitting such as (2) could not have much depth, since it is necessary for the consistency of a theory of measurement. The latter requires three kinds of macroscopic field: (i) metrical (gravitation); (ii) interaction (electromagnetic); (iii) creation (C-field). It has been shown[5] that the C-field is necessary for unambiguous interpretation of the 'arrow of time'.

The splitting (2) depends on algebraic specialization of the field of definition of the group, and a crucial question is: What is this specialization? This must provide a source of purely numerical invariants, such as fine structure, mass ratios, etc.

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GEOLOGY

Significance of Burrowing Structures in the Origin of Convoluted Laminae

THE origin of convoluted laminae in sedimentary sequences has long been disputed[1–6]. The two major hypotheses for the origin of convoluted laminae are: (1) deformation by current drag[1,2], and (2) deformation by subsequent loading[6]. Exceptionally well-exposed strata of Miocene age, containing convoluted laminae and burrowing structures formed by mud-feeding organisms, occur at Kaiti Beach, near Gisborne, North Island, New