

Quantum Mechanics_reduced properties

In Thermodynamics, the **reduced properties** of a fluid are a set of state variables normalized by the fluid's state properties at its critical point. These dimensionless thermodynamic coordinates, taken together with a substance's compressibility factor, provide the basis for the simplest form of the theorem of corresponding states.^[1]

Reduced properties are also used to define the Peng–Robinson equation of state, a model designed to provide reasonable accuracy near the critical point.^[2] They are also used to critical exponents, which describe the behaviour of physical quantities near continuous phase transitions.^[3]

Reduced pressure

The reduced pressure is defined as its actual pressure P divided by its critical pressure P_c :^[1]

$$p_r = \frac{P}{P_c}$$

Reduced temperature

The reduced temperature of a fluid is its actual temperature, divided by its critical temperature:^[1]

$$T_r = \frac{T}{T_c}$$

where the actual temperature and critical temperature are expressed in absolute temperature scales (either Kelvin or Rankine). Both the reduced temperature and the reduced pressure are often used in thermodynamical formulas like the Peng–Robinson equation of state.

Reduced specific volume

The reduced specific volume (or "pseudo-reduced specific volume") of a fluid is computed from the Ideal gas law at the substance's critical pressure and temperature:^[1]

$$v_r = \frac{v}{RT_c/P_c}$$

This property is useful when the specific volume and either temperature or pressure are known, in which case the missing third property can be computed directly.

References

1. ^ a b c d Cengel, Yunus A.; Boles, Michael A. (2002). *Thermodynamics: an engineering approach*. Boston: McGraw-Hill. pp. 91-93. ISBN 0-07-121688-X.
2. ^ Peng, DY, and Robinson, DB (1976). "A New Two-Constant Equation of State". *Industrial and Engineering Chemistry: Fundamentals* 15: 59-64. doi:10.1021/i160057a011.
3. ^ Hagen Kleinert and Verena Schulte-Frohlinde, *Critical Properties of ϕ^4 -Theories*, pp.8, World Scientific (Singapore, 2001); ISBN 981-02-4658-7 (Read online at [1])

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