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Diverging Thermodynamic Derivatives in Critical Phenomena in a Binary Liquid Mixture JAMES BAIRD, University of Alabma in Huntsville — The opposite sides of the coexistence curve of a binary liquid mixture with a miscibility gap converge at the critical solution temperature where certain of the thermodynamic derivatives go to infinity [1]. We examine three cases of solids in contact with a mixture of isobutyric acid + water, which has a critical solution temperature near 26 C: (a) The temperature derivative of the solubility, s, of a metal oxide goes to infinity as the temperature, T, approaches the critical temperature [2]. (b) When charcoal comes into contact with the liquid mixture, the derivative of isobutyric acid mole fraction with respect to chemical potential goes to infinity as T approaches the critical temperature [3]. (c) When the hydroxide form of an anion exchange resin comes into contact with isobutyric acid + water, the isobutyrate anion exchanges with the hydroxide ion. If the fraction of resin sites occupied by isobutyrate anions is assumed to be governed by the Langmuir adsorption isotherm, then the derivative of isobutyric acid mole fraction with respect to resin site mole fraction diverges as T approaches the critical temperature. We will show that all of these diverging derivatives follow as a consequence of the principle of critical point universality [1].

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