Assignment 1

Indian Institute of Science Education and Research

CHM202: Energetics and dynamics of chemical reactions

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Ques. 1 Write the SI units of van der Waals parameters *a* and *b*.

Ques. 2 A sample of hydrogen gas was found to have a pressure of 125 kPa when the temperature was 23°C. What can its pressure be expected to be when the temperature is 11°C?

Ques. 3 Derive Critical constants (P_C, T_C & V_C) for Berthelot equation of state and Dieterici equation of state.

Berthelot equation of state : $P = \frac{RT}{\bar{v}-b} - \frac{a}{T\bar{v}^2}$

Dieterici equation of state : $P = \frac{RT}{\bar{v}-b} e^{\left(\frac{-a}{RT\bar{v}}\right)}$

Ques. 4 For a gas obeying Vander waals equation, T_C = 304.2 K and P_C = 72.8 atm.
Calculate vander waal constant ‘a’ and ‘b’ for the gas.

Ques. 5 A vessel of volume 22.4 dm^3 contains 1.5 mol H_2 and 2.5 mol N_2 at 273.15 K. Calculate (a) the mole fractions of each component, (b) their partial pressures, and (c) their total pressure.

Ques. 6 Express the Berthelot equation of state and Dieterici equation of state in power series and calculate the second Virial coefficient for each.