Physical_Chemistry_2nd_YUGS_EV_ST

Name of a student ---------- Signature ---------- No. ----------

Mustansiriyah University
Department of Chemistry

1st SEM-2025_Bologna_Process
Mid_Exam_Class_A_Paper_A

Q1: Circle the right answer for all of the following **(50 Marks)**

1: liquefaction of the gas means which of the following?
(a) $Z = 1$ (b) $Z > 1$ (c) $Z < 1$ (d) $Z \neq 1$

2: In the van der Waals equation, what is the correct formula for the volume of the gas?
(a) n_i/n_T (b) V (c) V/m (d) V/n

3: If a gas has polar particles, then the difference between the volume of this gas is:
(a) $V_{Real} > V_{Perfect}$ (b) $V_{Real} < V_{Perfect}$ (c) $V_{Real} = V_{Perfect}$ (d) $V_{Real} \neq V_{Perfect}$

4: It can classify the type of reaction within adiabatic process as:
(a) reversible (b) isobaric (c) isothermal (d) free expansion

5: If it is required to measure the work done in an isochoric process, the value of work will be:
(a) zero (b) one (c) two (d) three

6: In a completely insulated system, the work done is in contact with which of the following?
(a) gas (b) system (c) surrounding (d) pressure

7: When the internal pressure of the system is equal to atmospheric pressure, the actual value will be:
(a) zero (b) one (c) two (d) three

8: During an isothermal reversible process, the change in temperature of the system is?
(a) variable (b) equal to zero (c) 25 °C (d) constant

9: Heat capacity is extensive property while molar heat capacity is ---------- property:
(a) proportional (b) intensive (c) extensive (d) direct

10: When ΔH = zero, the process is:
(a) isobaric (b) isochoric (c) isothermal (d) adiabatic

Q2: Using van der Waals equation, calculate the temperature of 5.0 mol of an unknown gas in a 5.0 L container at 80 bar. Compare this temperature with the value obtained from the ideal gas equation. $a = 0.0341\ L^2\ atm\ mol^{-2}$; $b = 0.0237\ L\ mol^{-1}$. **(25 Marks)**

Q3: 1100 J of heat energy was applied to (50 g, 27 g mol^{-1}) of aluminum metal. The temperature increased from 25 °C to 45 °C. Calculate $C_{p,m}$ of aluminum. **(25 Marks)**

Thu_11-12-2025 Best wishes Dr Abduljabbar I. R. Rushdi

Q2/ $n = 5.0\ mol,\ V = 5.0\ L,\ P = 80\ bar,\ a = 0.0341\ L^2\ atm\ mol^{-2}$

$b = 0.0237\ L\ mol^{-1} \qquad P = 80 \times 1 = 80\ P$

$$P = \frac{nRT}{V - ab} - \frac{an^2}{V^2} \Rightarrow T = \frac{V - ab}{nRP} - \frac{an^2}{V^2}$$

$$T = \frac{5.0L - 0.0341\ L^2\ atm\ mol^{-2} \times 0.0237\ L\ mol^{-1}}{5.0L - 3.1412\ atm\ L\ mol^{-1}\ K^{-1} \times 80\ P} - \frac{0.0341\ L^2\ atm\ mol^{-2}\ (5.0\ mol)^2}{(5.0L)^2}$$

$$T = \frac{5.4999}{5 - 24.6.2} - \frac{0.8525}{25}$$

$$T = 0.020 - 0.0341 = -0.0141\ K$$

Q3/

$T = 25 + 273 = 298\ K,\ T = 45 + 273 = 318\ K$

$$q_p = m C_{sm}\, \Delta t \Rightarrow C_{pm} = \frac{q_p}{m\, \Delta t}$$

$$C_{pm} = \frac{1100}{50 \times 20} = \frac{1100}{1000} = 1.1$$