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_B

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

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

2: What is the right formula that can be used for calculating the mole fraction of the gas in a mixture?
(a) V/n (b) n/V (c) V/m (d) n_i/n_T

3: A real gas behaves like an ideal gas, when which of the following is true?
(a) $pV_m/RT = 1$ (b) $pV_m/RT \neq 1$ (c) $pV_m/RT < 1$ (d) $pV_m/RT > 1$

4: Heat energy transfer can be measured by which of the following?
(a) thermometer (b) closed system (c) heat capacity (d) calorimeter

5: An isobaric process means which of the following?
(a) $\Delta T = 0$ (b) $\Delta p = 0$ (c) $C_v\Delta T = 0$ (d) $C_p\Delta T = 0$

6: The unit of C_p/C_v is:
(a) $J\ mol^{-1}K^{-1}$ (b) $J\ g^{-1}K^{-1}$ (c) $J\ mol^{-1}\ ^oC^{-1}$ (d) none of these

7: When the process cannot compensate the loss of q, then we can call it:
(a) isothermal (b) adiabatic (c) isobaric (d) isochoric

8: When the system is completely isolated, then ΔH can be calculated by which of the following?
(a) $p_{ex}\Delta V$ (b) $nRTLnV_f/V_i$ (c) $C_p\Delta T$ (d) ΔVU

9: $C_p > C_v$ due to which of the following?
(a) ΔU (b) Q (c) ΔH (d) R

10: When the process is reversible and $p_{in} > p_{ex}$, the process is called:
(a) isochoric (b) isothermal (c) isobaric (d) exothermic

Q2: Calculate the density of an unknown gas with a molar mass of 40 g mol^{-1} at STP conditions. (25 points)

Q3: A diatomic ideal gas is compressed reversibly and adiabatically at T_i of 67 °C to T_f of 450 K. Calculate (a) work was performed? (b) ΔU, (c) q and (d) ΔH. **(25 Marks)**

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

Q 2 //

density = ? / M = 40 g.mol^{-1} / at STP

Q2 5/25

STP → P = 1 atm, V = 22.4 L, n = 1 mole, T = 0°C + 273 = 273 K

$d = \frac{PM}{RT}$ Right eq!

$PV = nRT \Rightarrow D = \frac{RTn}{PV}$ wrong eq!

$M = \frac{m}{n}$

$D = \frac{0.082\ atm.L.K^{-1}.mol^{-1} \times 273K}{1\ atm \times 22.4\ L} = 0.99 \simeq 1\ g.L^{-1}$

Q 3 //

diatomic / rev and adiabatically / T_i = 67°C ⇒ 340K

T_f = 450K / w_{ad}, ΔU, q, ΔH = ?

Q3 20/25

① $w_{ad} = C_v \cdot \Delta T = 20\ J.K^{-1}.mol^{-1} \times 100K = 2000J \Rightarrow 2KJ$ (ΔT = 110K)

- $C_p = \frac{7}{2} \cdot R = 2.5 \times 8.314\ J.K^{-1}.mol^{-1} = 20.78\ J.K^{-1}.mol^{-1}$ (C_v or $\frac{5}{2}R$)
- $\Delta T = T_f - T_i = 450K - 340K = 100K$ (110K)

② $\Delta U = w_{ad}$, because this Process is adiabatically

$\Delta U = 2000J = 2KJ$

③ $q = 0$, because this Process is adiabatically

④ $\Delta H = \Delta U \Rightarrow 2000J$ $\Delta H = \Delta U + W$ so $\Delta H > \Delta U$