Exam 1 Calculations (Some ...)

1) $PV = nRT$ with focus on the units bar/atm, °C/°F/K, V_m

2) $P = \frac{nRT}{V-nb} - \frac{n^2a}{V^2}$ using tabulated values for a & b.

3) A "gas thermometer" extrapolation back to $P = 0$, to determine absolute zero.

4) $w = -\int P\,dV$

under const P; sim $V_f - V_i$

$$w = -P(V_f - V_i)$$

{ units bar · L ⇒ Pa m^3 = J

$\frac{1e5\ Pa}{1\ bar}$ $\frac{1e^{-3}\ m^3}{L}$

5) $q = (\text{mass } H_2O)\left(4.184\ \frac{J}{g\,°C}\right)\Delta T$

$= (\text{moles } H_2O)\left(75.379\ \frac{J}{mol\,°C}\right)\Delta T$

6) $w = \int_{\phi_i}^{\phi_f} \phi\,dQ$ under const potential (ϕ) ← voltage (volts)

$$w = \phi \cdot Q = \phi \cdot I \cdot t$$

(Q = charge; I = current; t = time)

V · Amps · sec = J

* do demo with heat gun

7) Heating Cooling curve worksheet

$q = (mass)(sp.\ ht)\,\Delta T$ s, l, g

$q = \Delta H_{\substack{fus \\ vap}} \cdot moles$

cold solid ⟶ hot gas calculation of q.

8) Heat capacity (C)

$C \rightarrow C_m \rightarrow \begin{cases} C_{p,m} \\ C_{v,m} \end{cases}$ $\quad C_p > C_v$

$C_{p,m} - C_{v,m} = R$

$C = \frac{q}{dT}$

9) Indicator diagrams: Rev vs Irrev processes

$w^{irrev}_{exp} = -P_{ext}(V_f - V_i)$

$w^{irrev}_{comp} = -P(V_f - V_i)$ $\quad w^{irrev}_{total} > 0$

isothermal const $P_{external}$

$w^{rev}_{exp} = -nRT \ln \frac{V_f}{V_i}$

$w^{rev}_{comp} = -nRT \ln \frac{V_f}{V_i}$ $\quad w^{rev}_{total} = 0$