Review topic for exam 1

Chapter 1

1) Definition of pressure
2) Pressure due to Hg column $\mathbf{P} = \rho g h$
3) Ideal gas law PV=nRT
4) Kinetic theory of gas

$$E_k = \frac{3}{2}nRT \quad \text{or} \quad \varepsilon_k = \frac{3}{2}k_B T \text{ for monoatomic gas}$$

5) Rate of effusion

$$\bar{\upsilon} \approx \frac{1}{\sqrt{\rho}} \quad \text{or} \quad \bar{\upsilon} \approx \frac{1}{\sqrt{M}}$$

6) Molecular collision

$$\lambda = \frac{\bar{\upsilon}_A}{Z_A} \qquad \text{Mean free path; Given collision diameter, find } \lambda$$

What is $\bar{\upsilon}_A$, Z_A given above eqn.?

7) $P = P_0 e^{\frac{-mg}{RT}Z} = P_0 e^{\frac{-E_p}{RT}}$

8) Maxwell distribution : Distribution shape for different T/ Gases

9) Real gas $Z = \frac{PV_m}{RT} \neq 1$

10) What is T_c? Shape of isotherms above/below T_c?

11) vdW eqn. $(P + \frac{a}{V_m^2})(v_m - b) = RT$

12) Law of corresponding states, reduced quantities

$$(P_r + \frac{3}{V_r^2})(V_r - \frac{1}{3}) = \frac{8}{3}T_r \text{ ; what is meaning?}$$

Chapter 2

1) What is first law of thermodynamics?
2) Reversible PV work = $-\int Pdv$
   maximum work?
3) Definition of C_p , C_v
   Relation C_p, C_v for ideal gas, liquid, solid
4) Enthalpy: $H = U + PV$
   P=const: $\Delta Q_P = \Delta H$; V=const: $\Delta Q_V = \Delta U$
5) Hess law
   Example in book: glucose $\rightarrow$ maltose, ΔH=?
6) Calculate ΔU, ΔH, Q for ideal gas processes,
   Isothermal, adiabatic, constant V,T; constant P,T

Chapter 3

1) Second law of thermodynamics
2) Carnot cycle (engine)

   Q, W, ΔU in each step; which step absorbs/releases heat?

$$\oint \frac{dQ_{rev}}{T} = 0; \quad \oint \frac{dQ_{irr}}{T} < 0$$

3) Entropy: $dS = \frac{dQ_{rev}}{T}$

4) $\int_A^B \frac{dQ_{irr}}{T} = 0$ for **adiabatic** process

   $\Delta S > 0$ for irreversible process

5) Calculate ΔS for phase changes
6) Calculate ΔS for ideal gas T, V changes
7) Calculate $_\Delta$S for mixing gases, solutions

   $\Delta S = -R \ (x_1 \ln x1 + x_2 \ln x_2)$

8) Third law of thermodynamics
9) Equilibrium conditions, what thermodynamic quantities
   characterize (determine) equilibrium under which conditions?
10) Direction of spontaneous process, when do the following
   conditions apply?

   $\Delta S > 0, \ \Delta G < 0, \ \Delta A < 0$