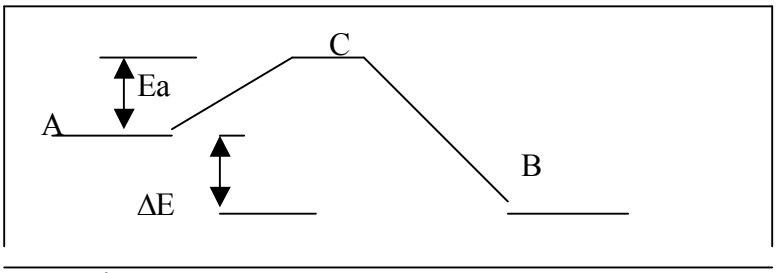
Key for test #2 Chem 102 Spring, 2005

Version A	Version B
Part I:	Part II:
1A, 2E, 3C, 4D, 5E, 6C, 7A, 8B,	1D, 2D, 3B, 4C, 5D, 6D, 7A, 8C
9 B, 10 E, 11D, 12D, 13B,	9C, 10B, 11A, 12E, 13E, 14A
14E, 15E, 16D, 17A, 18C, 19C, 20B	15E, 16E, 17C, 18B, 19E, 20B

Problems 21-25:

1) Problem on E_a, ΔE:



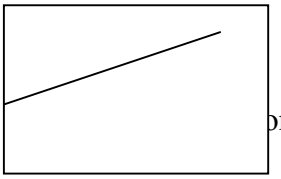
2) Problem involving reaction mechanism:
a) $NO_2+CO \rightarrow NO+CO_2$
b) NO_3 is an intermediate; it is generated in the first step and used up in the second step.
c) One of the NO_2 molecules is a catalyst, since it is used up in the first step and regerated in the second step.
d) Since the first step is slow (i.e. rate-determining), the rate law is rate = $k[NO_2]^2$.
e) Rate = $k[NO_2][CO]$

3) Problem involving simple cubic unit cell:
a) Edge length, a=2r so a = 2(1Å)=2Å = **$2x10^{-8}$ cm**
b) $V = (a)^3 = (2Å)^3 = 8Å^3$; or, $V = (2x10^{-8}cm)^3$ = **8×10^{-24} cm^3**
c) mass of unit cell = (1 atom/unit cell)(24g/mole)(1mole/$6x10^{23}$atoms)= **4×10^{-23}g**
d) density = m/V = $4 \times 10^{-23}g / 8 \times 10^{-24}$ $cm^3 = 0.5 \times 10^{(-23-(-24))}$ $g/cm^3 = 0.5 \times 10^1$ g/cm^3= **5 g/cm^3**

4) Problem involving vapor pressure and boiling point:
a) $\ln(P_2/P_1)=\Delta H/R\ (T_1^{-1}-T_2^{-1}) \Rightarrow \Delta H = R \ln(P_2/P_1)/ (T_1^{-1}-T_2^{-1}) = (10)(\ln(3))/(100^{-1}-200^{-1})=10(1)/(.01-.005)=2000J/mol$
b) Since we know P triples by T=200K, that means P=3(.333)=1 atm. Thus BP must be 200K since that is the temperature at which vapor pressure equals 1 atm. (no calculation really needed if you can figure this out). Otherwise you have to solve for T_2 in : $\ln(P_2/P_1)=\Delta H/R\ (T_1^{-1}-T_2^{-1})$
$\ln(P_2/P_1) / \Delta H/R - (1/T_1) = -1/T_2$: so $T_2 = 1/\{(1/T_1) - \ln(1.0\ atm/.333\ atm)/((2000/10\}$

5) Problem involving 2nd order reaction:

a) Show graph of 1/[A] (y-axis) vs t (x-axis). It has a positive slope and y intercept at $1/[A]_o$

b)  ons: $k = 1/A_o t_{1/2} = 1/(5.0\text{x}10^{-2})(10\text{min}) = 2\ M^{-1}\text{min}^{-1}$

c) It takes 10 minutes to drop 1/2. At that point, the half life changes: $t'_{1/2} = 1/\{(A_o/2)(k)\} = (2)(t_{1/2}) = 2(10) = 20$ minutes. So, after 10 minutes, we need another 20 minutes to halve the amount of reactant. The total time = 10+20 = 30 minutes.