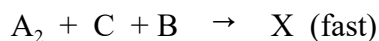
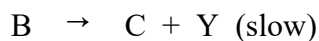
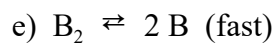
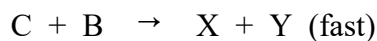
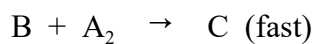
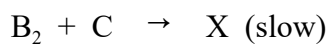
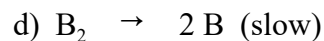
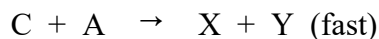
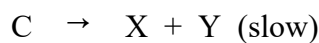
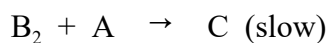
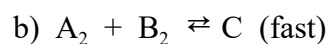
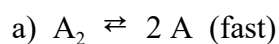
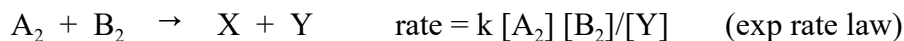


Name _____ Rec. TA/time _____

Show **ALL** your work or **EXPLAIN** to receive full credit.

1. (5 pts) A reaction with activation energy of 123 kJ/mol is originally at 38.0 °C. At what **temperature**, in °C, will its rate constant be double that at 38.0 °C?

2. (9 pts) Consider the following hypothetical reaction and the established rate law. Select an acceptable mechanism.



3. (9 pts) The following mechanism has been proposed for the gas phase reaction between H₂ and CO.



NOT on Carmen quiz. Just for practice.

(a) What is the overall reaction?

(b) What is (are) the **intermediate(s)** in the mechanism?

(c) What is the **molecularity** of each of the following elementary steps?

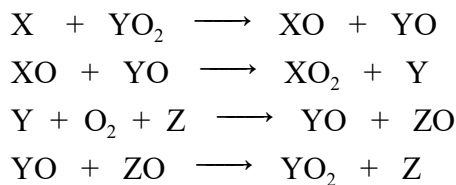
Step 1

Step 2

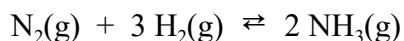
(d) What is the **rate-determining step** (explain why)?

(e) What is the **rate law** predicted by this mechanism?

4. (3 pts) Given the following mechanism, which answer below contains all species which may be classified as **catalyst(s)** in the formation of XO_2 from X and O_2 ($\text{X} + \text{O}_2 \rightarrow \text{XO}_2$)?



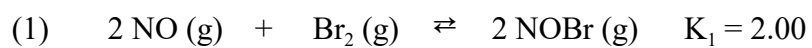
- a) YO_2 and Y b) YO and ZO c) XO, YO_2 , and Z
d) XO, YO, Y and ZO e) YO_2 and Z
5. (3 pts) Which response contains all the following statements that are **TRUE** and no false statements?
1. From the Arrhenius equation one can say that the **rate constant** always **decreases** as **temperature rises**.
 2. The activation energy, E_a , for a reaction generally does **not** change as temperature changes (i.e. E_a is treated as a constant).
 3. The activation energy, E_a , is usually about the **same** as ΔH (or ΔE) for a reaction.
 4. A **catalyst increases** the **rate** of a reaction by **lowering** the **activation energy**, E_a .
 5. A **catalyst increases** the **kinetic energy** of the **reactants**.
- a) 5 b) 1, 3 c) 3, 5 d) 2, 4 e) 3, 4, 5
6. (3 pts) The equilibrium constant for the following reaction is 70 at 350°C . A system at equilibrium has $[\text{N}_2] = 0.200 \text{ M}$ and $[\text{NH}_3] = 0.118 \text{ M}$. What is the $[\text{H}_2]$?



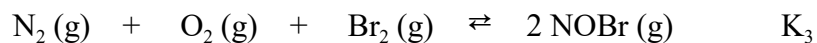
7. (3 pts) The properly written heterogeneous K_c expression for the following reaction as written is:



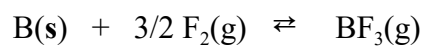
8. (5 pts) Given the following two equilibrium reactions,



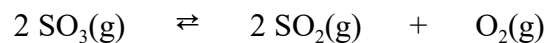
What is the equilibrium constant, K_3 , for the reaction below?



9. (4 pts) The equilibrium constant K_c for the following reaction at 1100°C is 6.80×10^{51} . What is K_p ?



10. (5 pts) The following reaction is started with 2.000 moles of SO_3 in a 2.000-L container. When equilibrium is reached there are 1.645 moles of SO_3 in the container. What is the value of the **equilibrium constant, K_c** ? (**Show the ICE table. You can use numbers or variables in your ICE table.**)



11. (3 pts) A plot of $\ln(r)$ vs. $\ln[A]$ has a slope of -2.5 and an intercept of -10.55. Determine the **rate constant** and **order** of the reaction for the rate law, $r = k[A]^n$.

USEFUL INFORMATION

$$R = 0.08206 \text{ L-atm/mol-K} = 8.3145 \text{ J/mol-K}$$

	IA	IIA	IIIB	IVB	VB	VIB	VIIIB	VIIIIB						IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1.008 H 1																			4.003 He 2	
2	6.941 Li 3	9.012 Be 4												10.811 B 5	12.011 C 6	14.007 N 7	15.999 O 8	18.998 F 9	20.179 Ne 10		
3	22.990 Na 11	24.305 Mg 12												26.98 Al 13	28.09 Si 14	30.974 P 15	32.06 S 16	35.453 Cl 17	39.948 Ar 18		
4	39.098 K 19	40.08 Ca 20	44.96 Sc 21	47.88 Ti 22	50.94 V 23	52.00 Cr 24	54.94 Mn 25	55.85 Fe 26	58.93 Co 27	58.69 Ni 28	63.546 Cu 29	65.38 Zn 30	69.72 Ga 31	72.59 Ge 32	74.92 As 33	78.96 Se 34	79.904 Br 35	83.80 Kr 36			
5	85.47 Rb 37	87.62 Sr 38	88.91 Y 39	91.22 Zr 40	92.91 Nb 41	95.94 Mo 42	98 Tc 43	101.07 Ru 44	102.91 Rh 45	106.42 Pd 46	107.87 Ag 47	112.41 Cd 48	114.82 In 49	118.69 Sn 50	121.75 Sb 51	127.60 Te 52	126.90 I 53	131.39 Xe 54			
6	132.91 Cs 55	137.33 Ba 56	138.91 La 57	178.39 Hf 72	180.95 Ta 73	183.85 W 74	186.21 Re 75	190.23 Os 76	192.22 Ir 77	195.08 Pt 78	196.97 Au 79	200.59 Hg 80	204.38 Tl 81	207.2 Pb 82	208.98 Bi 83	209 Po 84	210 At 85	222 Rn 86			
7	223 Fr 87	226.03 Ra 88	227.03 Ac 89	261 Rf 104	262 Ha 105	263 Sg 106	262 Ns 107	265 Hs 108	266 Mt 109	269 110	272 111	277 112									

Lanthanide Series	140.12 Ce 58	140.91 Pr 59	144.24 Nd 60	145 Pm 61	150.36 Sm 62	151.96 Eu 63	157.25 Gd 64	158.93 Tb 65	162.50 Dy 66	164.93 Ho 67	167.26 Er 68	168.93 Tm 69	173.04 Yb 70	173.04 Lu 71
Actinide Series	232.04 Th 90	231.04 Pa 91	238.03 U 92	237.05 Np 93	Pu 94	Am 95	Cm 96	Bk 97	Cf 98	Es 99	Fm 100	Md 101	No 102	Lr 103

A PERIODIC CHART OF THE ELEMENTS
(Based on ¹²C)