

General Instructions:

- (i) Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit. Models are allowed.
- (ii) Print your name on each page.
- (iii) Please keep your paper covered and your eyes on your own work. Misconduct will lead to failure in the course.

1. (10 points) Draw a structure that corresponds to each of the following names. Show all atoms in each structure, including hydrogen atoms.

(a) Z-2-bromo-2-octene

(b) 1,6-heptadiene

Name _____

2. (16 points) CFCl_3 was one of the first widely-used refrigerants, but it is very harmful to Earth's ozone layer. Therefore, this compound was replaced by CHFCl_2 , which is less destructive to the ozone layer; however, CHFCl_2 is now in disfavor because it has a strong greenhouse effect (causes global warming). Answer the questions below.

(a) Provide a drawing of CHFCl_2 that indicates the three-dimensional structure.

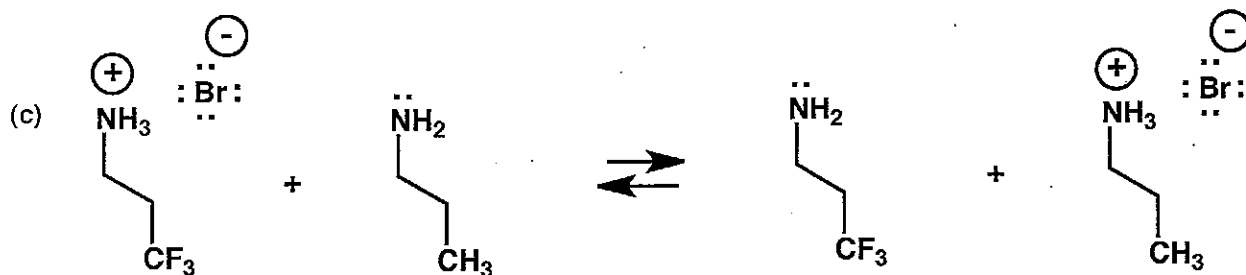
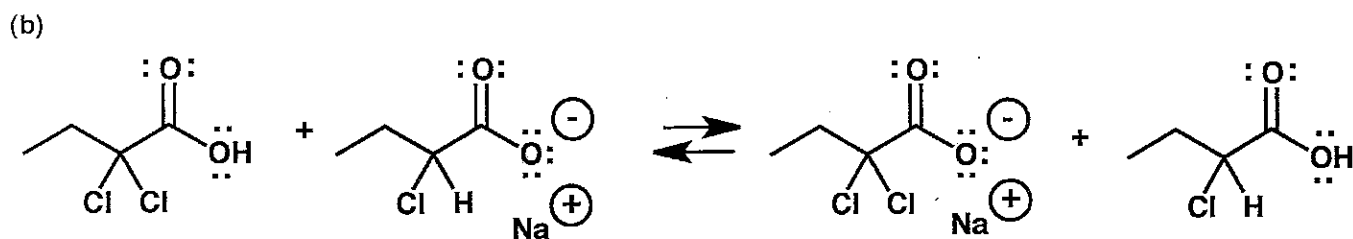
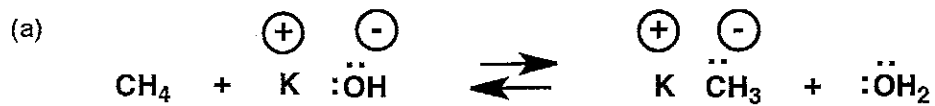
(b) Indicate the F-C-Cl bond angle (approximation) in the box.



(c) Provide an energy diagram that shows how the relevant atomic orbitals combine to form the molecular orbitals of one C-Cl bond, and where the bonding electrons are expected to reside. Assume that Cl is sp^3 hybridized.

Name _____

3. (12 points) For each equilibrium shown below, do two things:

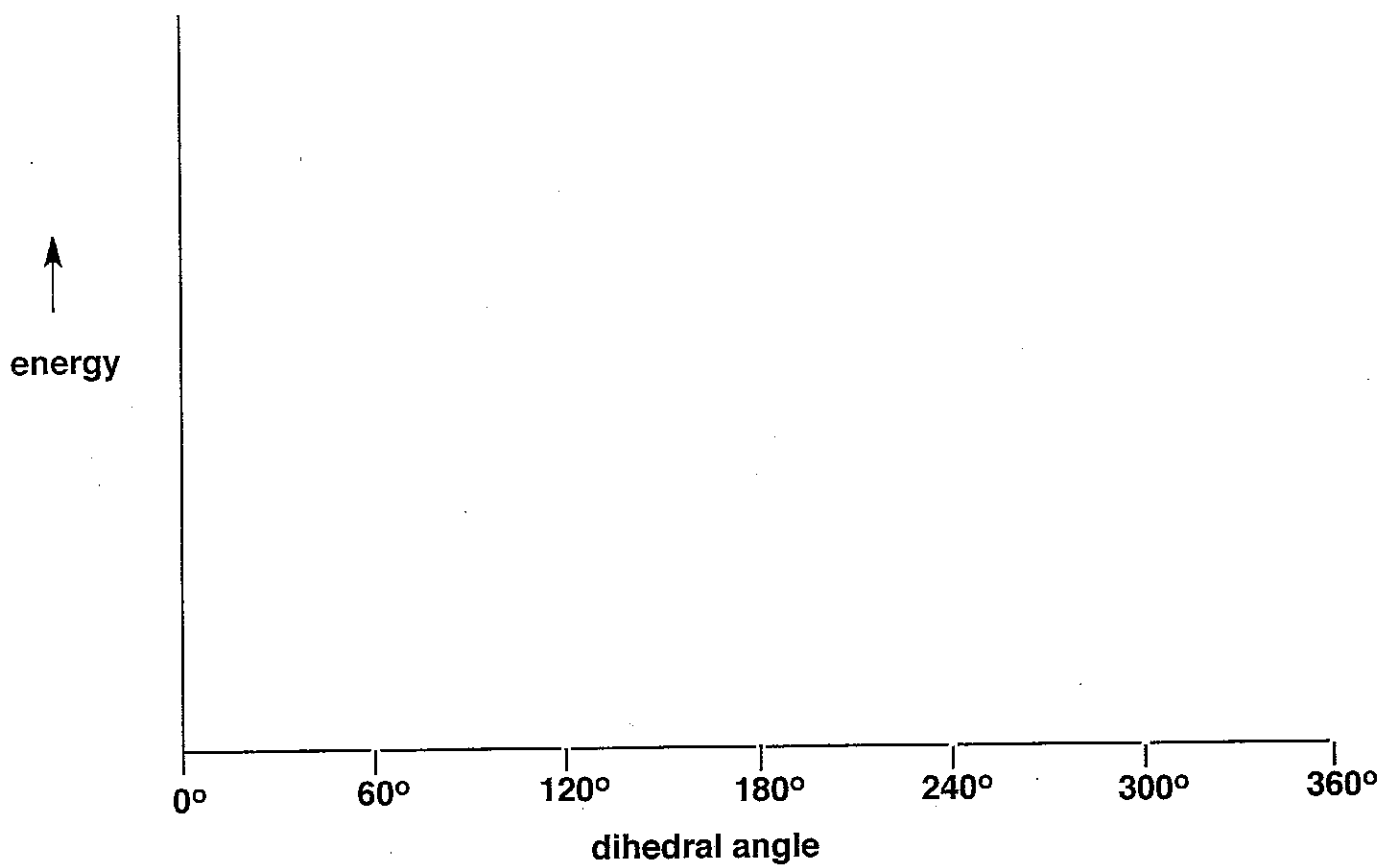
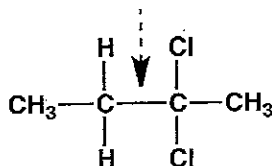
(i) Put a **SQUARE** around the **STRONGER BASE**, of the two species that are serving as bases in the equilibrium.(ii) Put a **CIRCLE** around the **SIDE** of the equilibrium that you expect to be **MORE FAVORED**.

4. (25 points)

(a) Draw the energy diagram for rotation about the indicated carbon-carbon bond (dotted arrow) of the molecule shown below. Draw appropriate chemical structures for each minimum and each maximum in the energy function.

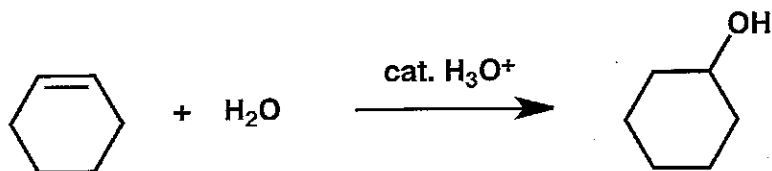
CIRCLE the most stable structure(s).

NOTE: A methyl group is larger (causes more steric repulsion) than a Cl atom.



Name: _____

5. (12 points) Provide a mechanism ("curved arrows") for the reaction shown below. You do not have to account for the way that H_3O^+ is formed. Show every atom in each structure you draw.



Name _____

6. (25 points)

Draw FIVE isomers with the formula C_7H_{14} that would ALL give the same major product upon reaction with HCl (without any rearrangement) and that would ALL generate 3-methylhexane upon reaction with H_2 and Pd/C.

<u>Problem #</u>	<u>Score</u>
1	/ 10
2	/ 16
3	/ 12
4	/ 25
5	/ 12
6	/ 25

Total: / 100

Periodic Table of the Elements

		<table border="1" style="margin: auto;"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">H</td> <td style="text-align: center;">1.008</td> </tr> </table>		1	H	1.008											<table border="1" style="margin: auto;"> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">He</td> <td style="text-align: center;">4.003</td> </tr> </table>	2	He	4.003																																	
		1	H	1.008																																																	
2	He	4.003																																																			
3	Li	6.94	4	Be	9.01											10	Ne	20.18																																			
11	Na	22.99	12	Mg	24.31											17	Cl	35.45	18	Ar	39.95																																
19	K	39.10	20	Ca	40.08	21	Sc	44.96	22	Ti	47.90	23	V	50.94	24	Cr	52.00	25	Mn	54.94	26	Fe	55.85	27	Co	58.93	28	Ni	58.71	29	Cu	63.55	30	Zn	65.37	31	Ga	69.72	32	Ge	72.59	33	As	74.92	34	Se	78.96	35	Br	79.90	36	Kr	83.80
37	Rb	85.47	38	Sr	87.62	39	Y	88.91	40	Zr	91.22	41	Nb	92.91	42	Mo	95.94	43	Tc	98.91	44	Ru	101.07	45	Rh	102.91	46	Pd	106.4	47	Ag	107.87	48	Cd	112.40	49	In	114.82	50	Sn	118.69	51	Sb	121.75	52	Te	127.60	53	I	126.90	54	Xe	131.30
55	Cs	132.91	56	Ba	137.34	57	La	138.91	72	Hf	178.49	73	Ta	180.95	74	W	183.85	75	Re	186.2	76	Os	190.2	77	Ir	192.2	78	Pt	195.09	79	Au	196.97	80	Hg	200.59	81	Tl	204.37	82	Pb	207.19	83	Bi	208.98	84	Po	(209)	85	At	(210)	86	Rn	(222)
87	Fr	(223)	88	Ra	226.03	89	Ac	(227)	104	Unq*	(261)	105	Ump*	(262)	106	Unh*	(263)	107	Uns*	(262)	108	Uno*	(265)	109	Una*	(266)																											

58	Ce	140.12	59	Pr	140.91	60	Nd	144.24	61	Pm	(145)	62	Sm	150.35	63	Eu	151.96	64	Gd	157.25	65	Tb	158.93	66	Dy	162.50	67	Ho	164.93	68	Er	167.26	69	Tm	168.93	70	Yb	173.04	71	Lu	174.97
90	Th	232.04	91	Pa	(231)	92	U	238.03	93	Np	(237)	94	Pu	(244)	95	Am	(243)	96	Cm	(247)	97	Bk	(249)	98	Cf	(249)	99	Es	(254)	100	Fm	(257)	101	Md	(258)	102	No	(259)	103	Lr	(260)

Lanthanides
Actinides

*Symbol (and name) provisional. Numbers in parentheses: available radioactive isotope of longest half-life.

