Hour Exam #1
Chemistry 343
Professor Gellman
7 October 2016

Last Name _____

First Name _____

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.

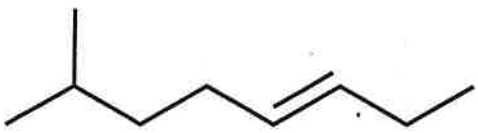
1. (6 points) For each side-by-side pair of structures, CIRCLE the one that more correctly conveys the way electrons are distributed.

(a) $H_3C—H$ vs. $H_3C:^{\ominus}\ H^{\oplus}$

(b) $H_3C—\ddot{O}—Na$ vs. $H_3C—\ddot{O}:^{\ominus}\ Na^{\oplus}$

(c) $H_3C—\ddot{O}—H$ vs. $H_3C—\ddot{O}:^{\ominus}\ H^{\oplus}$

2. (7 points) Show the expect product or products of the reaction below.



+ HCl ⟶

Name _____ 00015

3. (32 points) For each of the molecules drawn below, determine whether each of the descriptive phrases (1-6) is applicable. Write as many of the indicated numerals as appropriate on the line below each molecule. Numerals may be used more than once, or not at all.

1 = Contains at least one bond angle formed by three carbon atoms of approximately 109.5°.

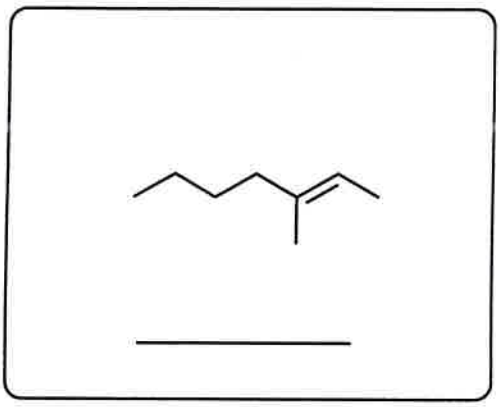
2 = Contains at least one bond angle formed by three carbon atoms of approximately 120°.

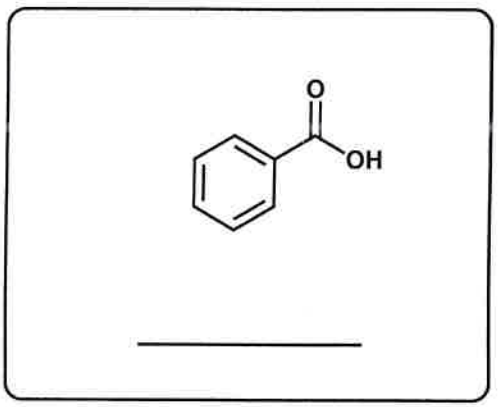
3 = Contains at least one bond angle formed by three carbon atoms of approximately 180°.

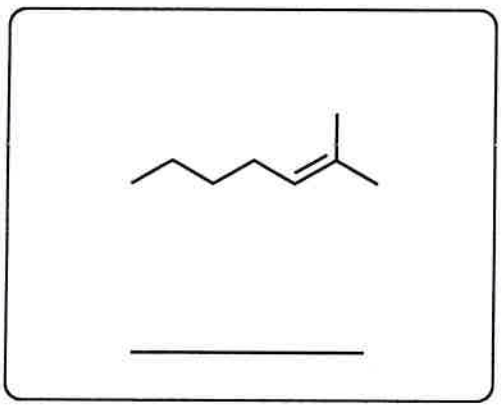
4 = E configuration

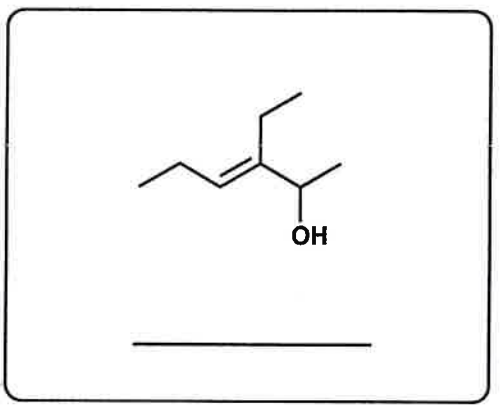
5 = Z configuration

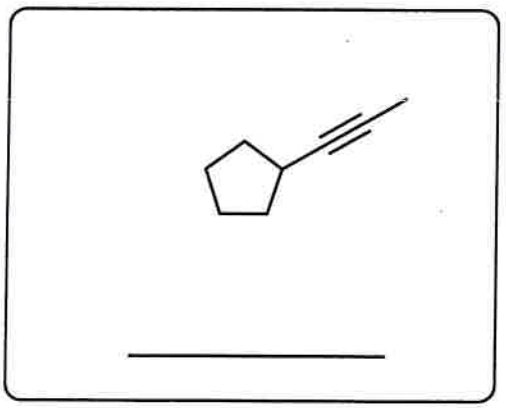
6 = Contains at least one H with $pK_a < 20$.

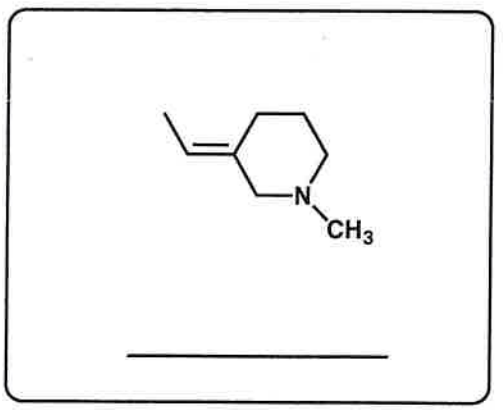








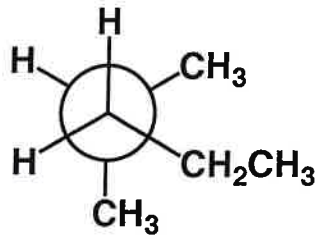




Name _____

4. (20 points)

(a) The Newman diagram below indicates the three-dimensional structure when the molecule is viewed by looking along one specific carbon-carbon bond. Complete a new drawing of the same molecule from a different perspective, in which the specific carbon-carbon bond is viewed from the side (i.e., the perspective is rotated by 90°). That carbon-carbon bond is already drawn, on the right side below; your job is to draw in the rest of the molecule. The new drawing should show exactly the same conformation as is indicated by the Newman projection.



C——C

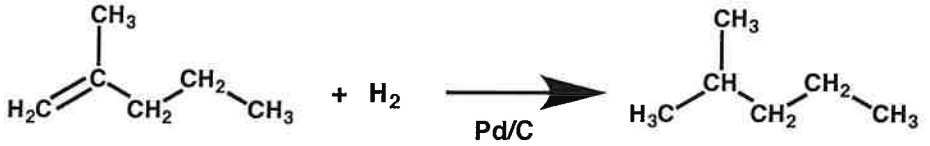
(b) Provide two new drawings, one a Newman projection and the other a 'side-on' view, of the molecule discussed above in part (a), but now showing the most stable conformation about the carbon-carbon bond that was focused on above. (If there is more than one "most stable" conformation, just show one.)

(c) In addition to the carbon-carbon bond focused upon in parts (a) and (b), there is one other carbon-carbon bond for which different conformations are expected to have different energies. Draw a Newman projection that shows the most stable conformation for this carbon-carbon bond.

5. (15 points)

Name _____

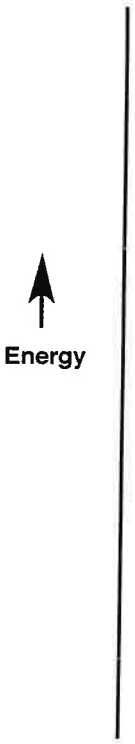
(a) Shown are hydrogenation reactions for three alkenes, A, B and C, and the corresponding heats of hydrogenation. Indicate the relative energies of the starting materials and the products on the energy diagram below. Specifically, use short horizontal lines, with appropriate labels, to indicate the relative energies of these species. The relative positions (up or down the page) of these lines should indicate which species are of relatively higher or lower energy. Draw vertical lines, with clear labels, to indicate each of the heats of hydrogenation. (Do not include "curved" lines to indicate the course of the reaction; in other words, do not indicate transition states.)

A  -28.1 kcal/mol

B  -30.0 kcal/mol

C  -26.7 kcal/mol

Starting Materials ***Products***



(b) Below, indicate the order of decreasing stability among alkenes A-C, with the MOST STABLE on the LEFT.

_____ > _____ > _____

Name _____

6. (20 points)

(a) Propose TWO possible structures for molecules with the formula C_6H_{12} that do not undergo reaction when exposed to H_2 in the presence of Pd/C.

(b) Propose TWO possible structures for molecules with the formula C_6H_{10} that would be expected to react with only one molar equivalent of H_2 in the presence of Pd/C. Both of the molecules you show below should give the same product after they have reacted with one equivalent of H_2 in the presence of Pd/C.

Name _____

Problem #	Score
1	/ 6
2	/ 7
3	/32
4	/20
5	/15
6	/20

_____

Total: /100

00015

Periodic Table of the Elements

UW-Madison

IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1 H 1.01																	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.30											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	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 88.90	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La* 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89 Ac* 227	104 Rf 261	105 Db 262	106 Sg 263	107 Bh 262	108 Hs 265	109 Mt 266	110 269	111 272	112						

* Lanthanides	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 145	62 Sm 150.36	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
** Actinides	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 262