

CHEM 3303

Scores in Reverse Numerical Order

EXAM #1	EXAM #2	
90	96	
88	94	
88	94	A
85	89	
84	79	
80	79	
76	79	
75	79	B
68	75	
66	75	
65	72	
63	69	
63	68.08	Average
61.59	68	
60	64	
59	62	C
59	62	
58	60	
54	58	
51	55	
49	55	
49	54	D
48	54	
42	50	
41	45	F
35	35	
34		
33		

Organic Chemistry I

Name _____

KEY

CHEM 3303

EXAM #2

Thursday, September 18, 2008

Don't forget:

Use a pencil.

Erase errors.

Avoid ambiguous and/or redundant answers.

Stay in your seat.



Periodic Table of the Elements

1A	Periodic Table of the Elements																8A			
1	1 H 1.0794											2 He 4.002602								
2	3 Li 6.941	4 Be 9.0121											5 B 10.811	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.179		
3	11 Na 22.9898	12 Mg 24.305						8B							13 Al 26.9815	14 Si 28.0855	15 P 30.9738	16 S 32.066	17 Cl 35.453	18 Ar 39.948
4	19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.88	23 V 50.941	24 Cr 51.9961	25 Mn 54.9380	26 Fe 55.847	27 Co 58.993	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.59	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80		
5	37 Rb 85.467	38 Sr 87.62	39 Y 88.9059	40 Zr 91.224	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.9055	46 Pd 106.42	47 Ag 107.868	48 Cd 112.41	49 In 114.82	50 Sn 118.710	51 Sb 121.75	52 Te 127.60	53 I 126.9045	54 Xe 131.29		
6	55 Cs 132.9054	56 Ba 137.33	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.85	75 Re 186.207	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.9665	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)		
7	87 Fr (223)	88 Ra 227.027	89 Ac 227.027	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (265)	109 Mt (268)											

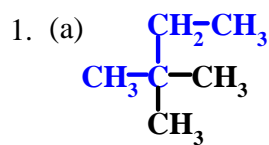
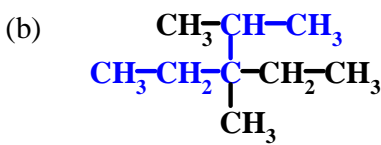
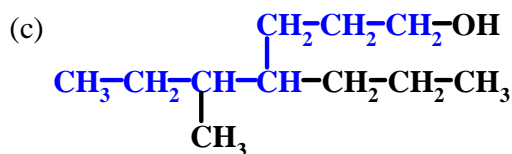
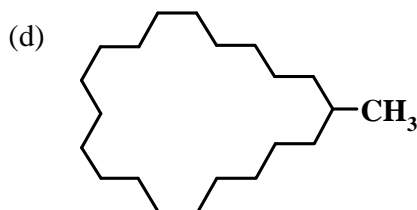
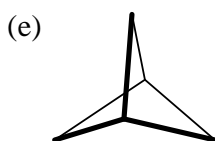
Lanthanide Series

58 Ce 140.12	59 Pr 140.9077	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.9254	66 Dy 162.50	67 Ho 164.9304	68 Er 167.26	69 Tm 168.9342	70 Yb 173.043	71 Lu 174.967
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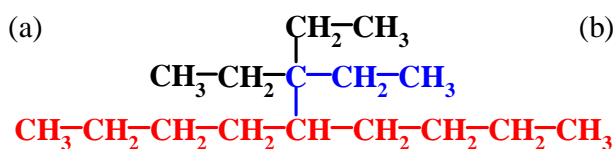
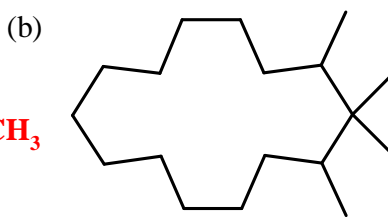
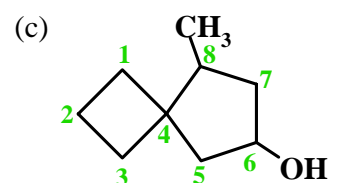
Actinide Series

90 Th 232.0381	91 Pa 231.0359	92 U 238.0289	93 Np 237.0482	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 (260)
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SCORE _____

Answer items 1-8 (10 points each) on the test paper; do *not* turn in your scratch paper.**2,2-dimethylbutane****3-ethyl-2,3-dimethylpentane****5-methyl-4-propyl-1-heptanol****methylcycloeicosane****bicyclo[1.1.1]pentane**

2. Give the I.U.P.A.C. name of each of the following:

**5-(1,1-diethylpropyl)nonane****1,1,2,14-tetramethylcyclotetradecane****8-methylspiro[3.4]octan-6-ol****ALWAYS SHOW YOUR CALCULATIONS IN QUANTITATIVE PROBLEMS LIKE #3 AND #4!**

3. The specific rotation of (**S**)-benzoin is $+115^\circ$.
The specific rotation of a certain **R-S** mixture of benzoin enantiomers is $+69^\circ$.

(a) Calculate the enantiomeric excess (ee%) for this mixture.

$$ee = \frac{[\alpha]_M}{[\alpha]_S} = \frac{+69^\circ}{+115^\circ} = 0.60 = 60\%$$

(b) Calculate the mole fraction of S isomer in this mixture.

$$x_S = \frac{1}{2}(0.60 + 1) = \frac{1}{2}(1.60) = 0.800 = 0.800$$

4. The ΔG value for the difference between *axial* and *equatorial* fluorocyclohexane is 0.25 kcal/mole. $R = 1.987$ cal/K•mole and $25^\circ\text{C} = 298$ K. What is the *axial-equatorial* ratio for the fluoro group at 25°C ?

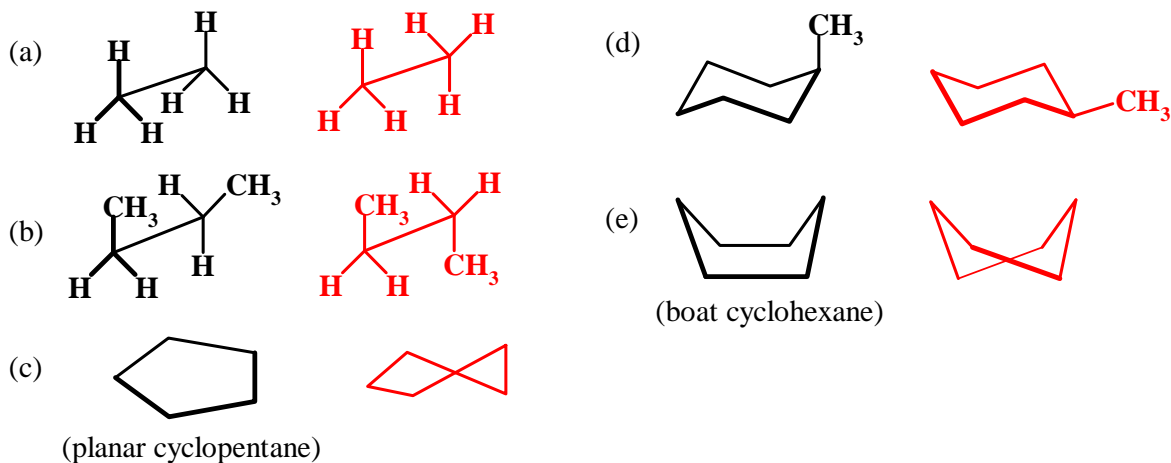
$$K = e^{-\Delta G^\circ/RT}$$

$$\frac{\Delta G^\circ}{RT} = \frac{(250 \text{ cal/mole})}{(1.987 \text{ cal/K}\cdot\text{mole})(298 \text{ K})}$$

$$= 0.422$$

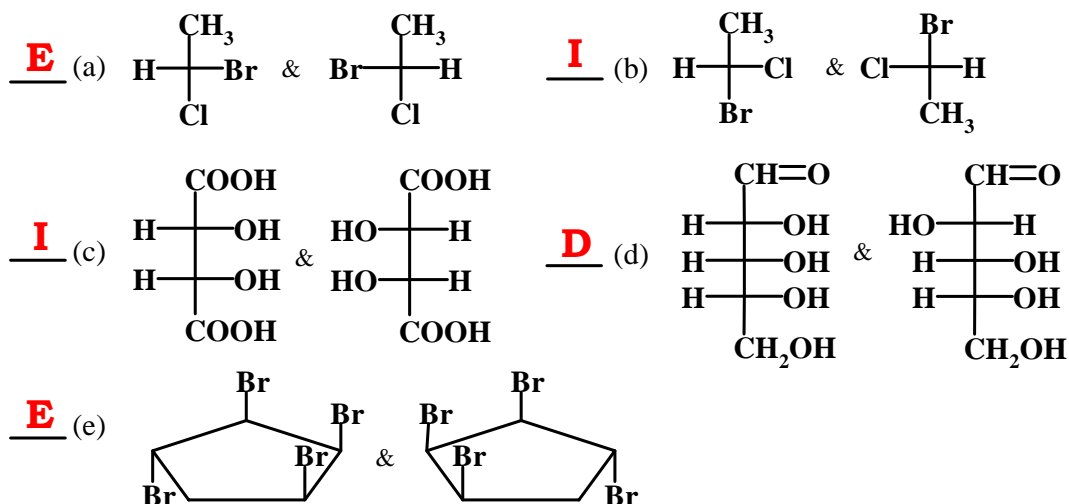
$$e^{-0.422} = 0.6556 \Rightarrow 0.7$$

5. Draw the structure of a less strained (more stable) conformation in each case:

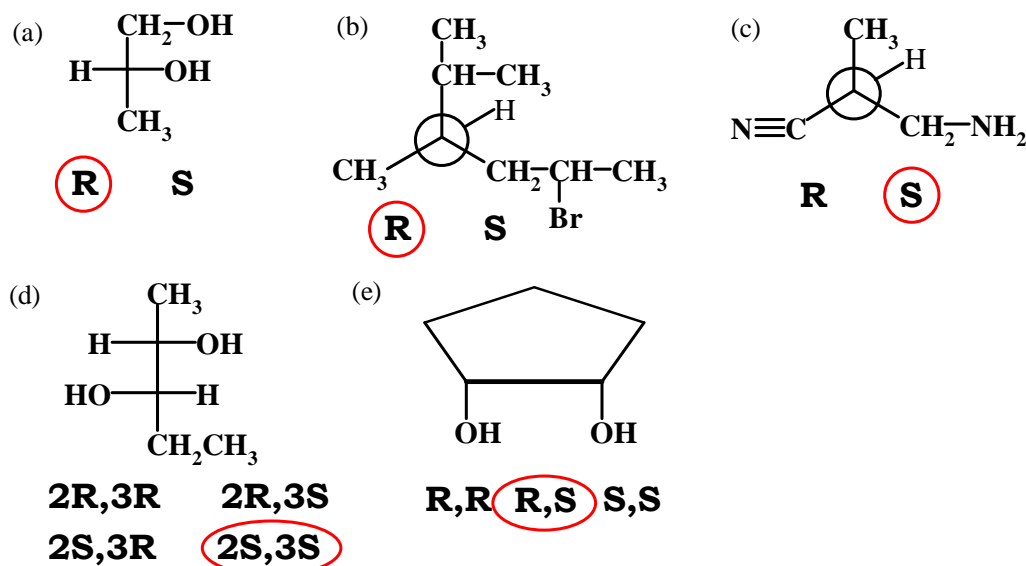


6. Classify each of the following pairs of structures as:

I. Identical E. Enantiomers D. Diastereomers



7. Classify each of the structures (a)—(e) according to one of the R-S type designations directly below the structure, encircling the correct response:



8. Encircle whichever of the following

(a) has a higher boiling point: $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH}$ or $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-SH}$

(b) has a higher boiling point: $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH}$ or $\text{HO-CH}_2\text{-CH}_2\text{-OH}$

(c) has a higher boiling point: $\text{CH}_3\text{-C(=O)-CH}_3$ or $\text{CH}_3\text{-C(=CH}_2\text{)-CH}_3$

(d) has a higher boiling point: $\text{CH}_3\text{-C(=O)-CH}_3$ or H_2O

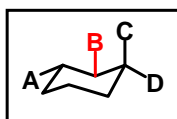
(e) has a larger molecular dipole moment: $\text{CH}_3\text{-C(=O)-CH}_3$ or H_2O

MULTIPLE CHOICE: Use the "Scantron" type ANSWER SECTION at the bottom of this page for items 9–13.

(4 points each)

DOUBLE CHECK to make sure you marked the response you intended.

9. Which of the labeled bonds in the cyclohexane molecule to the right is incorrect, being neither *axial* nor *equatorial*?



A. A B. B C. C D. D

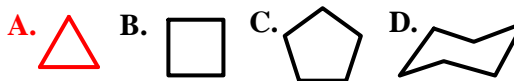
10. Which of the following molecules does not have a chiral center (stereocenter)?

A. 2-bromohexane C. 3-bromohexane
B. **2-methylhexane** D. 3-methylhexane

11. Which of the following has the highest melting point?

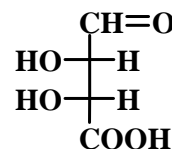
A. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$
B. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$
C. $\text{CH}_3\text{-CH(CH}_3\text{)-CH}_2\text{-CH}_3$ D. **$\text{CH}_3\text{-C(CH}_3\text{)}_2\text{-CH}_3$**

12. Which has the largest (most highly negative) heat of combustion, $\Delta H^\circ_{\text{comb}}$ per CH_2 group?



13. The molecule to the right is

A. *erythro*.
B. *threo*.
C. *meso*.
D. *frito*.



ANSWER SECTION: Blacken in (do not encircle!) the response corresponding to your answer to each of the above items, using a soft lead pencil.

9. (A) **(B)** (C) (D) 12. **(A)** (B) (C) (D)
10. (A) **(B)** (C) (D) 13. **(A)** (B) (C) (D)
11. (A) (B) (C) **(D)**