

# CHEM 3303

## Scores in Reverse Numerical Order

EXAM #1	
90	
88	
88	A
85	
84	
80	
76	B
75	
68	
66	
65	
63	
63	C
61.59	Average
60	
59	
59	
58	
54	
51	D
49	
49	
48	
42	
41	F
35	
34	
33	

# Organic Chemistry I

Name \_\_\_\_\_

**KEY**

**CHEM 3303**

**EXAM #1**

**Tuesday, September 2, 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	<b>Periodic Table of the Elements</b>																8A
1 H 1.0794																	2 He 4.002602
2 3 Li 6.941	2A 4 Be 9.0121											3A 5 B 10.811	4A 6 C 12.011	5A 7 N 14.0067	6A 8 O 15.9994	7A 9 F 18.9984	10 Ne 20.179
3 11 Na 22.9898	12 Mg 24.305	3B	4B	5B	6B	7B	8B	1B	2B	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
--------------------	----------------------	--------------------	-------------------	--------------------	--------------------	--------------------	----------------------	--------------------	----------------------	--------------------	----------------------	---------------------	---------------------

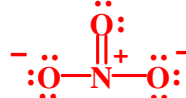
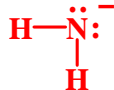
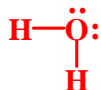
Actinide Series

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)
----------------------	----------------------	---------------------	----------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	--------------------	--------------------	--------------------	--------------------

SCORE \_\_\_\_\_

Answer items 1-8 (10 points each) on the test paper;  
do **not** turn in your scratch paper.

1. Draw a dot-dash structure, including all unshared pairs of electrons and formal charges (if any), for each of the following:

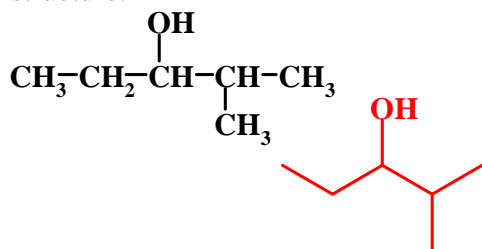


2. Complete the following structure for the azide ion ( $\text{N}_3^-$ ) by adding unshared pairs of electrons and formal charges. Draw a more stable resonance form. Draw the structure of a molecule that is isoelectronic with the azide ion.

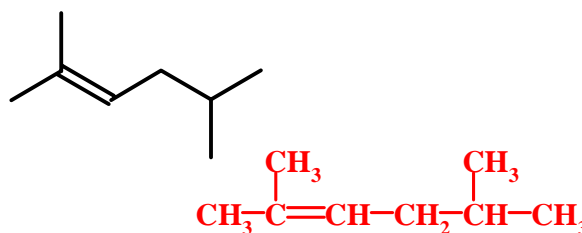


isoelectronic molecule  
other examples possible

3. (a) Draw a bond line (line angle) structure from the following condensed structure:



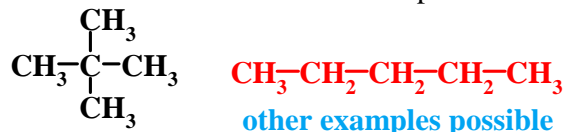
- (b) Draw a condensed structure from the following bond line (line angle) structure:



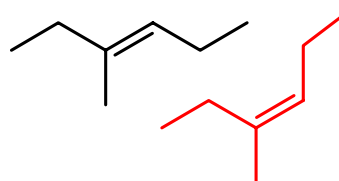
- (c) Write the formula for a Lewis acid with an open sextet (empty  $p$  orbitals).



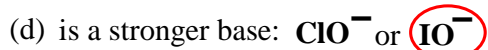
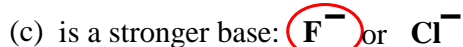
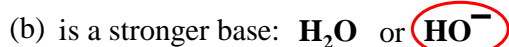
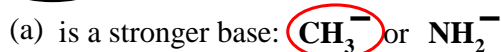
- (d) Draw a condensed or bond line structure for a constitutional isomer of neopentane:



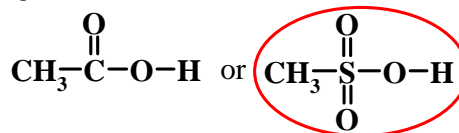
- (e) Draw a condensed or bond line structure for a geometric isomer of *trans*-3-methyl-3-hexene:



4. Encircle whichever of the following:



- (e) is a stronger acid:





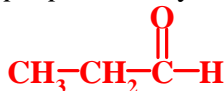
Based on the above examples,

draw a **condensed** or **bond line** structure for each of the following, (a)—(c):

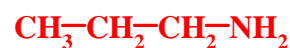
(a) methyl *propyl* ether



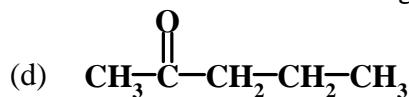
(b) *propionaldehyde*



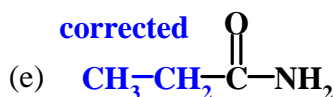
(c) *propylamine*



and name each of the following, (d) & (e):



**methyl propyl ketone**



**propionamide**

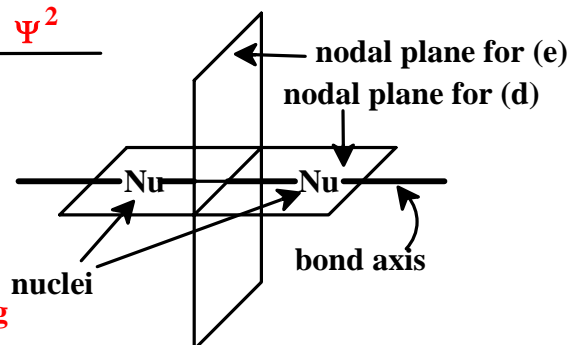
6. (a) What type of hybridized orbital is associated with *trigonal* geometry?  $sp^2$

(b) What is the value of the Schrödinger wave function ( $\Psi$ ) in a nodal plane? zero

(c) What function is interpreted as the probability of finding an electron in a given location in space?  $\Psi^2$

(d) What kind of molecular orbital has a nodal plane that includes the two nuclei (Nu—Nu) and the bond axis?  $\pi$

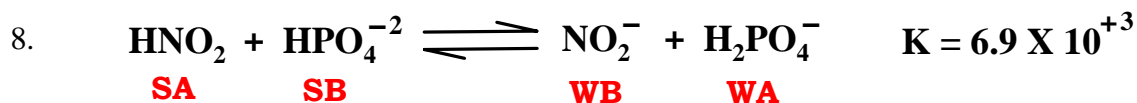
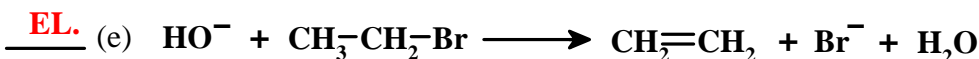
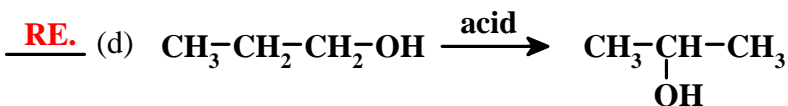
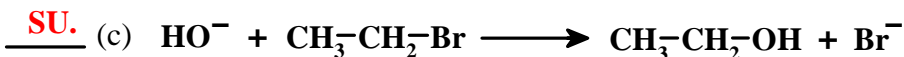
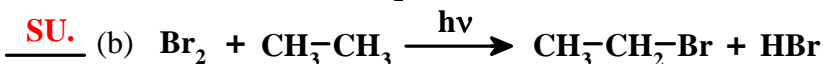
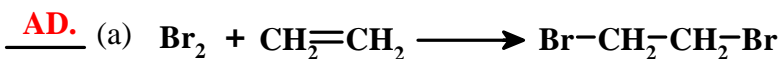
(e) What kind of molecular orbital has a nodal plane directly between the two nuclei, perpendicular to the bond axis? antibonding



7. Classify each of the following reactions (a)—(e) as...

**SU.** Substitution    **EL.** Elimination    **AD.** Addition    **RE.** Rearrangement

...by placing the appropriate letters in the space provided.

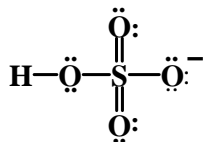


Label the strong acid (SA), the strong base (SB), the weak acid (WA), and the weak base (WB) in the equation above.

**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. The oxidation number of sulfur, in the bisulfate ion shown to the right, is

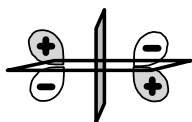


A. +1 B. -2 C. +6 D. +7

10. What is the conjugate base of the hydrogen phosphate ion,  $\text{HPO}_4^{2-}$ ?

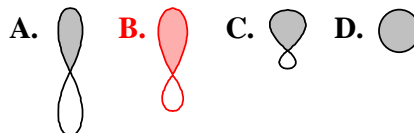
A.  $\text{H}_3\text{PO}_4$  B.  $\text{H}_2\text{PO}_4^-$  C.  $\text{HAsO}_4$  D.  $\text{PO}_4^{3-}$

11. The molecular orbital illustrated to the right is



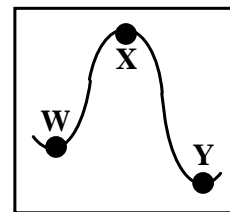
A.  $\sigma$  B.  $\sigma^*$  C.  $\pi$  D.  $\pi^*$

12. Which of the following most likely represents an  $sp^3$  orbital?



13. In the potential energy diagram to the right, the point X represents

A. a transition state.  
B. a reactive intermediate.  
C. a resonance hybrid.  
D. a reactant.



Electronic Reorganization

**ANSWER SECTION:** Blacken in the response corresponding to your answer to each of the above items, using a soft lead pencil.

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