

CHEM 3311
Dr. Minger

Hour Exam #1
June 12, 2018

Name _____

Circle your recitation section: 111 112 113 114 115

121 122 123 124 125 141 142

Sign the Honor Code pledge:

I pledge that on my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this exam.

Signature

General Instructions: There are 4 pages of questions. Be sure you have them all. Read each question carefully so that you know exactly what is being asked and what you need to write or draw. DO NOT USE COLORED INK. Your work on scratch pages will not be graded, so be sure everything you want graded is written on the exam itself.

1A 2A 3A 4A 5A 6A 7A 8A

hydrogen 1 H 1.0079																	helium 2 He 4.0026						
lithium 3 Li 6.941	beryllium 4 Be 9.0122																	boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305																	aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selecnium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80						
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29						
caesium 55 Cs 132.91	barium 56 Ba 137.33	* 57-70	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]					
francium 87 Fr [223]	radium 88 Ra [226]	* *	lanthanum 103 La [262]	hafnium 104 Rf [261]	actinium 105 Ac [262]	thorium 106 Th [264]	protactinium 107 Pa [264]	uranium 108 U [268]	neptunium 109 Np [269]	plutonium 110 Pu [271]	americium 111 Am [272]	curium 112 Cm [277]	berkelium 113 Bk [277]	californium 114 Cf [285]	einsteium 115 Es [285]	fermium 116 Fm [287]	mendeleevium 117 Md [288]	nobelium 118 No [289]					

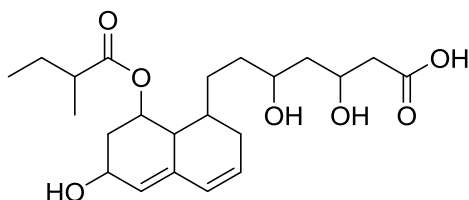
* Lanthanide series

lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteium 99 Es [252]	fermium 100 Fm [257]	mendeleevium 101 Md [258]	nobelium 102 No [259]

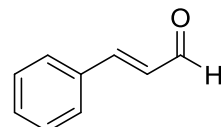
** Actinide series

1) Indicate which functional groups are present in each of these molecules by writing the appropriate letters in the box below each molecule. (14 pts)

- | | | | | | |
|---|---------|---|-----------------|---|---------------|
| A | Alkene | F | Aldehyde | L | Anhydride |
| B | Alkyne | G | Ketone | M | Acid halide |
| C | Alcohol | H | Carboxylic acid | N | Amine |
| D | Ether | J | Ester | O | Nitrile |
| E | Epoxide | K | Amide | P | Aromatic ring |

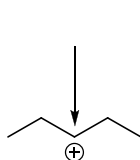


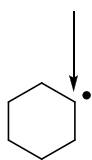
Pravastatin
Cholesterol-lowering drug

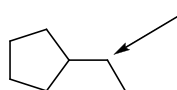


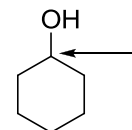
3-Phenylprop-2-enal
Flavoring compound isolated from
cinnamon tree bark

2) How many hydrogen atoms are attached to each of the indicated carbons? Write your answer in the box under each structure. All charges are shown. (8 pts)

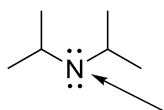


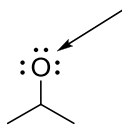


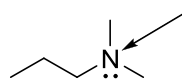




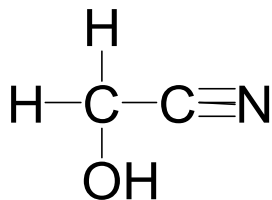
3) Calculate the formal charge for each of the indicated atoms. All lone pairs are shown. Write your answer in the box under each structure. (3 pts)



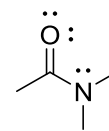
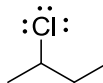
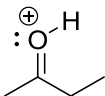
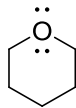




- 4) Identify the two orbitals that overlap to form each of the indicated bonds in the structure shown. All atoms in the structure are neutral, but lone pairs are not shown (you will have to draw them in). (16 pts)



- C-N σ _____ on C and _____ on N
- C-O σ _____ on C and _____ on O
- C-C σ _____ on left C and _____ on right C
- C-N π (either) _____ on C and _____ on N
- 5) Choose the best description of the hybridization of each of the indicated atoms. Choices are sp , sp^2 , sp^3 . (4 pts)



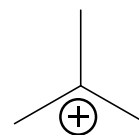
Oxygen: _____

Carbonyl carbon: _____

Carbon #2: _____
(this is 2-chlorobutane)

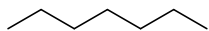
Nitrogen: _____

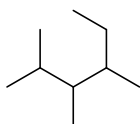
- 6) The carbon with the positive charge has four valence shell orbitals (just like all carbons). Complete the table by writing how many of each type of valence orbital there are on this carbon. If there are no orbitals of a particular type on that carbon, write "0" (zero). (5 pts)

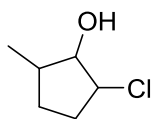


Orbital type	s	p	sp	sp^2	sp^3
How many?					

- 7) Provide acceptable IUPAC (systematic) names for each of the following molecules (15 pts).







- 8) Draw the requested molecules in the boxes provided and circle the correct choice underneath each name to classify the compound. (10 pts)

***Tert*-butyl alcohol**

Classify this alcohol
(circle one):

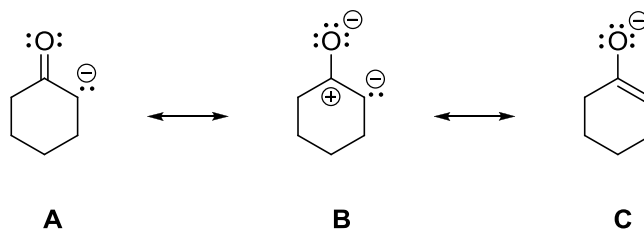
1° 2° 3°

Isopropyl chloride

Classify this alkyl halide
(circle one):

1° 2° 3°

- 9) Select the major resonance contributor. All lone pairs are shown in all structures. (5 pts)



- a. A
 b. B
 c. C
 d. A and C
 e. All structures are equivalent
- 10) Give TWO reasons why you chose the structure you did as the major contributor. (The reasons do not have to be listed in order of importance.) (10 pts)

Reason 1:

Reason 2:

- 11) Draw **one** other reasonable resonance contributor for each of the chemical species shown. Show the conversion of the original structure to your new structure using the appropriate curved arrow(s). Include all lone pairs and nonzero formal charges to receive full credit. Be sure your arrows are drawn clearly. (10 pts)

