CHEM 3311 **Exam #1** **Name** Key
Dr. Minger **June 8, 2015**

Please read and sign the Honor Code statement below:

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.

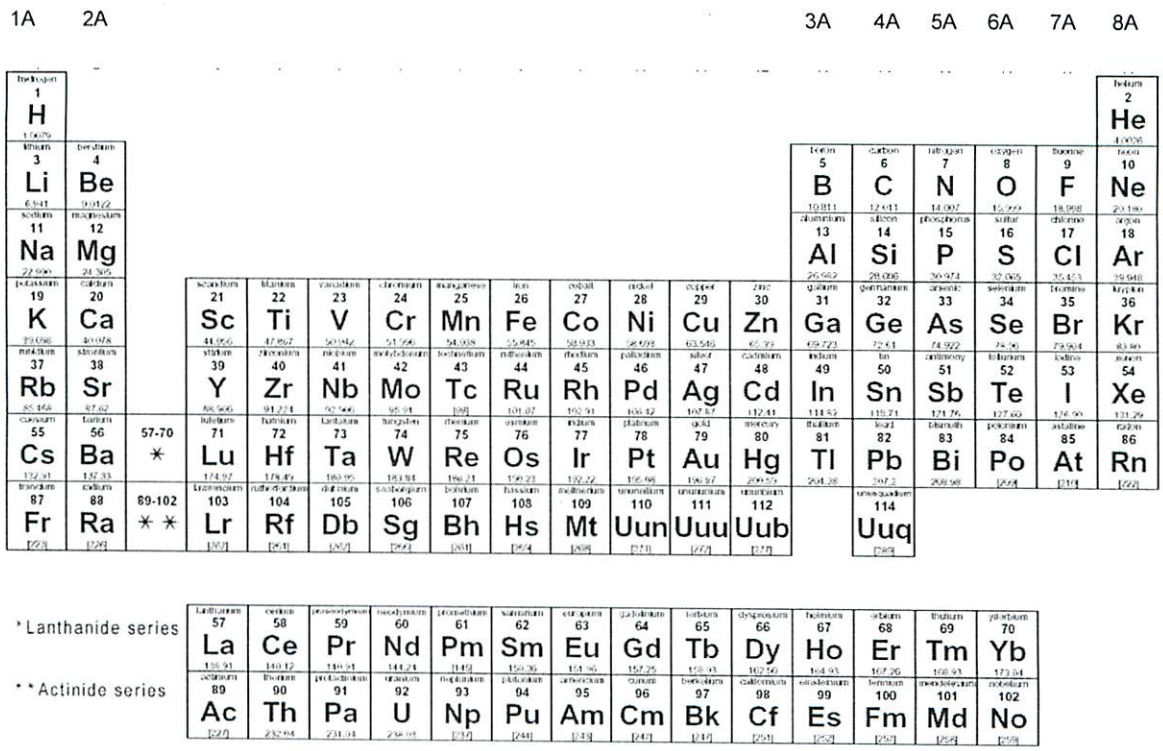
_____
Signature

General Instructions: There are 20 questions. Be sure you have them all. Read each question carefully so that you know exactly what is being asked.

Each multiple choice question (1-20) is worth **5 points and has only one correct answer.** Bubble in your answers to these questions on the Scantron provided. **Only the Scantron will be graded, not anything that you write on the exam.**

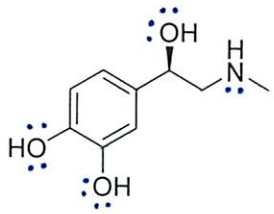
At the end of the exam, turn in your Scantron and this signed cover sheet. You may keep the rest of the exam to check your answers against the key later.

Good luck!



1. Certain individuals experience a severe allergic reaction when stung by bees. This potentially life-threatening allergic reaction is called anaphylaxis and is commonly treated by an injection of epinephrine:

E



Epinephrine

All atoms in the structure are neutral, but the lone pairs have not been included explicitly. How many lone pairs of electrons should be shown in the structure of epinephrine?

a. Four lone pairs
b. Six lone pairs
c. Eight lone pairs
d. Ten lone pairs
(e.) The number of lone pairs is not listed in the answer choices a-d

There are 7

2. Which of these functional groups is present in epinephrine?

amine, alcohol, aromatic ring

B

a. Amide
(b) Amine
c. Ketone
d. Ester
e. Ether

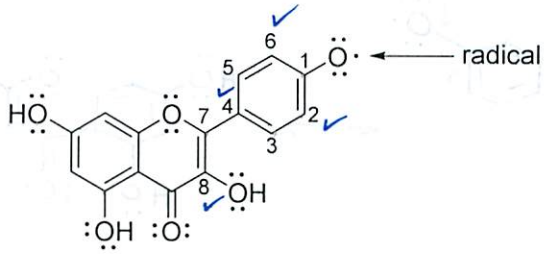
3. Certain functional groups can be classified as primary, secondary or tertiary. Two such groups are contained in epinephrine. Which statement best describes the classification of the two groups?

B

There is a secondary amine and a secondary alcohol.

a. Both are primary.
(b) Both are secondary.
c. One is primary and one is secondary.
d. One is primary and one is tertiary.
e. One is secondary and one is tertiary.

4. Kaempferol is an antioxidant compound found in various foods, including blackberries, Brussels sprouts, and spinach.



Kaempferol radical

A

The structure of kaempferol shown above has been converted to a radical. By drawing other resonance structures for this chemical species, we can show that the radical can be delocalized to various carbon atoms in the structure. Several of the carbon atoms have been labeled with numbers in the structure.

On which of the following carbon atoms will the radical NOT appear in the other resonance contributors?

(See next page)

(a.) 1
b. 4
c. 6
d. 8
e. The radical will appear on all of these carbon atoms.

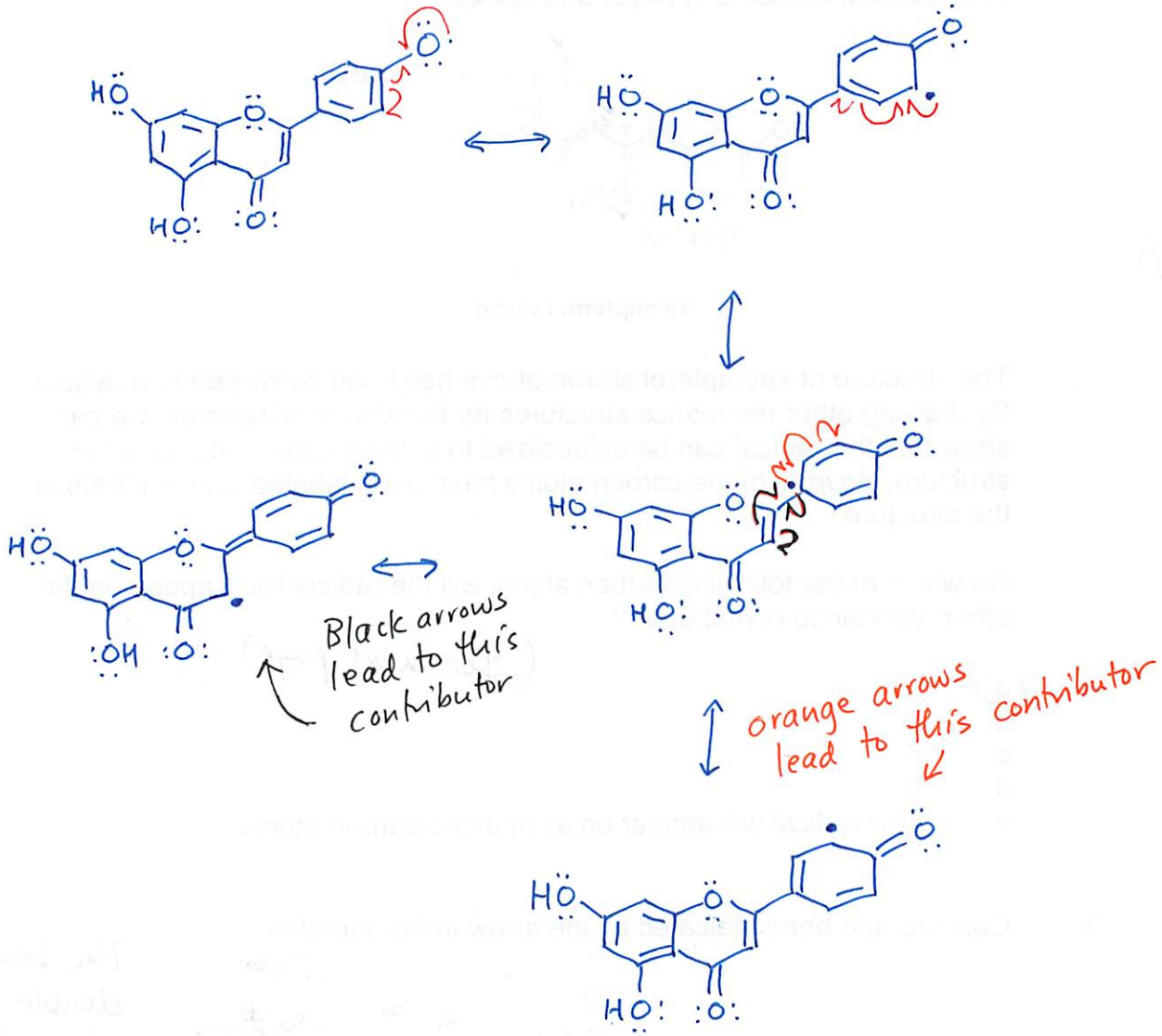
5. Consider the bond indicated by the arrow in this structure:

The bond has double bond character also.

E

A typical C-O single bond length is 143 pm (pm = picometer) and a typical C=O bond is 123 pm. What do you expect the bond length of the indicated bond to be?

a. 123 pm
b. 143 pm
c. More than 143 pm
d. Less than 123 pm
(e.) In between 123 and 143 pm


Black arrows lead to this contributor
orange arrows lead to this contributor

6. Eucalpytol is a major component of eucalyptus oil. It has an interesting cyclic structure, shown below. What type of compound is eucalyptol?

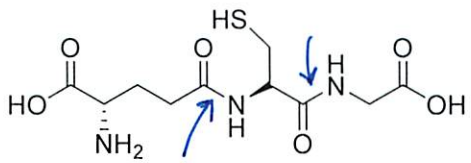
E

Eucalyptol

a. Alcohol
b. Amine
c. Anhydride
d. Ester
(e.) Ether

7. Glutathione is an antioxidant found in plants, fungi, and bacteria. Although it is not a protein, it does contain peptide bonds. How many peptide bonds are there in glutathione?

B



Glutathione

a. 1
(b.) 2
c. 3
d. 4
e. 5

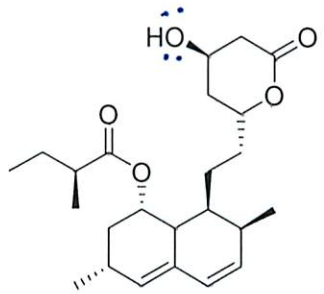
8. Which of these compounds is *not* a constitutional isomer of 2,3-dimethylbutane?

A

(a) 2,2,3-trimethylbutane
b. 2-methylpentane
c. 3-methylpentane
d. hexane

2,3-dimethylbutane
C_6H_{14}

9. Lovastatin is a compound used for the treatment of high cholesterol:



Lovastatin

C

According to valence bond theory, what orbitals are overlapping to form the OH σ bond? (Lone pairs are not explicitly shown in the structure.)

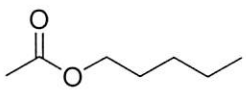
a. *sp* on O and *s* on H
b. sp^2 on O and *s* on H
(c.) sp^3 on O and *s* on H
d. *p* on O and *s* on H

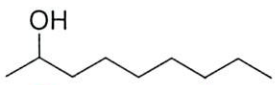
10. How many π bonds are there in lovastatin?

D

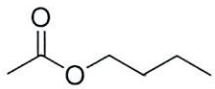
a. 1
b. 2
c. 3
(d.) 4 Two C-C π and two C-O π
e. 5

11. In class, you saw *isoamyl acetate*. This compound is a component of banana oil and part of the mixture of substances injected by bees when they sting. The mixture also includes these compounds:

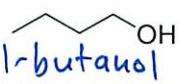




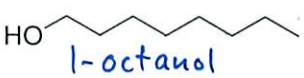
2-nonanol



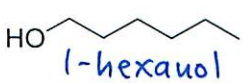
B



1-butanol



1-octanol



1-hexanol

Which of these compounds is *not* included in the set shown above?

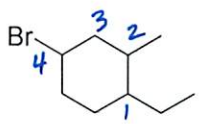
a. 1-octanol
(b.) 2-octanol
c. 1-hexanol
d. 1-butanol
e. 2-nonanol

12. Which of these functional groups in contained in this structure?

B

a. Alcohol
b. Aldehyde
c. Amine
d. Carboxylic acid
e. None of these

13. What is the correct IUPAC name for this compound?

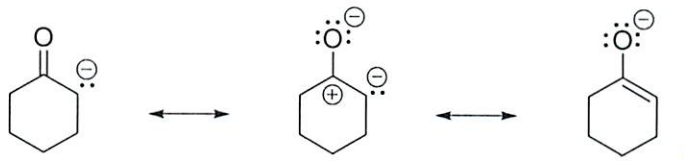


A

a. 4-bromo-1-ethyl-2-methylcyclohexane
b. 1-bromo-3-methyl-4-ethylcyclohexane
c. 1-bromo-4-ethyl-3-methylcyclohexane
d. 1-ethyl-2-methyl-4-bromocyclohexane
e. None of these

14. Select the major resonance contributor. All lone pairs are shown in all structures.

C

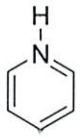


A B C

⊖ on most EN atom

a. A
b. B
c. C
d. A and C
e. All structures are equivalent

15. What is the formal charge on nitrogen in this structure? All lone pairs of electrons are shown.



Valence # − (nonbonding e⁻ + # of bonds)

= 5 − (0 + 4) = 1

B

a. 0
b. +1
c. −1
d. +2
e. −2

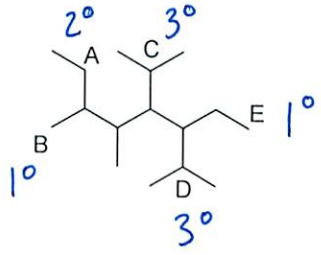
16. What is the hybridization of the carbonyl carbon in a ketone?

B

a. *sp*
b. sp^2
c. sp^3
d. The carbonyl carbon is not hybridized

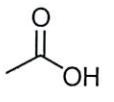
17. Some of the carbons in this structure are labeled. Which of them is a secondary carbon?

A

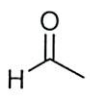


18. Which of these compounds is a carboxylic acid derivative?

E

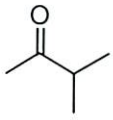


A
carboxylic acid

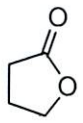


B
aldehyde

C
ketone



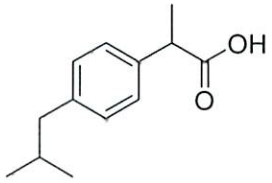
D
ketone



E
ester

19. The structure of ibuprofen contains a benzene ring. What is the percentage of *p* character for the hybrid orbitals on a carbon in the benzene ring?

D



Ibuprofen

a. 25%
b. 33.3%
c. 50%
(d) 66.7%
e. 75%

These carbons are sp^2 hybridized; thus they have ~66.7% p character.

20. The common name for 5-(1-methylethyl)nonane is

C

a. 5-*tert*-butylnonane
b. 5-*sec*-butylnonane
(c) 5-isopropylnonane
d. 5-isobutylnonane