Multiple Choice

Section 1.1
Difficulty Level: Easy
1. Which is the electronic configuration that describes Mg^{2+}?

a) $1s^2$, $2s^2$
b) $1s^2$, $2s^2$, $2p^6$
c) $1s^2$, $2s^2$, $2p^6$, $3s^2$
d) $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$

Section 1.1
Difficulty Level: Easy
2. Which is the electronic configuration that describes C?

a) $1s^2$, $2s^2$, $2p^5$
b) $1s^2$, $2s^2$, $2p^6$, $3s^2$
c) $1s^2$, $2s^2$, $2p^2$
d) $1s^2$, $2s^2$, $2p^6$

Section 1.1
Difficulty Level: Easy
3. Which ion is described by the electronic configuration $1s^22s^22p^63s^23p^2$?

a) Mg^+
b) Al^+
c) Si^+
d) P^+

Section 1.1
Difficulty Level: Easy
4. Which atom is described by the electron configuration $1s^22s^22p^63s^23p^5$?

a) S
b) Se
c) Cl
d) Br

Section 1.1
Difficulty Level: Easy
5. Carbon has how many valence electrons?

a) 2
b) 4
c) 6
d) 8

Section 1.1
Difficulty Level: Easy
6. Oxygen has how many valence electrons?

a) 4
b) 5
c) 6
d) 7

Section 1.1
Difficulty Level: Easy
7. Nitrogen has how many valence electrons?

a) 4
b) 5
c) 6
d) 7

Section 1.1
Difficulty Level: Medium
8. Which statement about orbitals is false?

a) Orbitals are regions of space where electrons are found.
b) Orbitals may contain up to two electrons.
c) Orbitals are filled in order of decreasing energy.
d) Orbitals of equivalent energy are half filled before adding two electrons to any one of them.

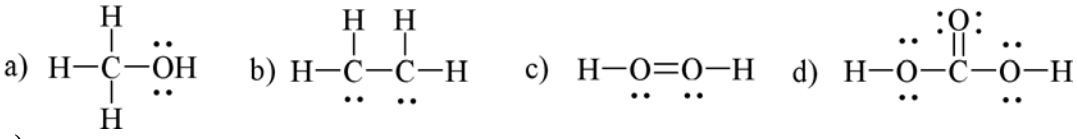
Section 1.2
Difficulty Level: Easy
9. Which atom is described by the Lewis structure  ?

a) C
b) P
c) Se
d) I

Section 1.2
Difficulty Level: Easy
10. Which atom is described by the Lewis structure  ?

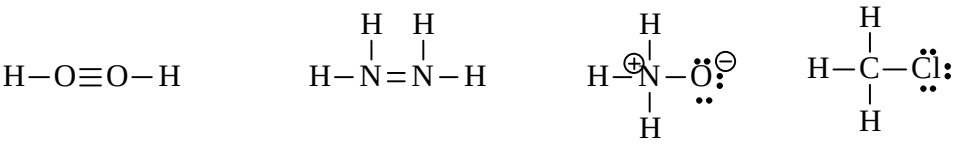
a) C
b) P
c) Se
d) I

Section 1.2
Difficulty Level: Medium
11. Which Lewis structure is correct?
HINT: Count the electrons around each center in step 1 and check, whether the charges (or the absence of them) is correct in step 2.



a) a
b) b
c) c
d) d

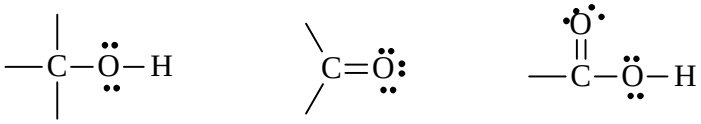
Section 1.2
Difficulty Level: Medium
12. Which Lewis structures are correct?
HINT: Count the electrons around each center in step 1 and check, whether the charges (or the absence of them) is correct in step 2.



I II III IV

a) I, II
b) II, IV
c) III, IV
d) I, III

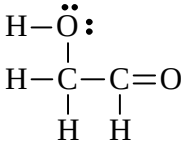
Section 1.2
Difficulty Level: Medium
13. Which functional groups have correct Lewis structures?



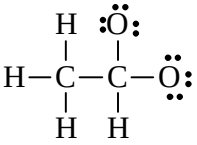
hydroxyl I carbonyl II carboxyl III

a) I, II
b) II, III
c) I, II, III
d) I, III

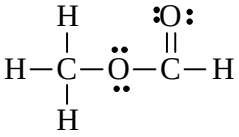
Section 1.2
Difficulty Level: Hard
14. Which is the correct Lewis structure for acetic acid (CH_3CO_2H)?



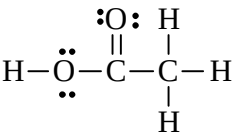
a)



b)



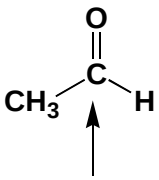
c)



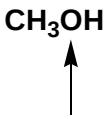
d)

a) a
b) b
c) c
d) d

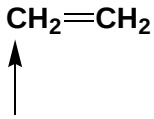
Section 1.3
Difficulty Level: Medium
15. Using the VSEPR model, predict which atoms have bond angles of about 120°.



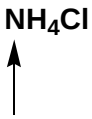
I



II



III



IV

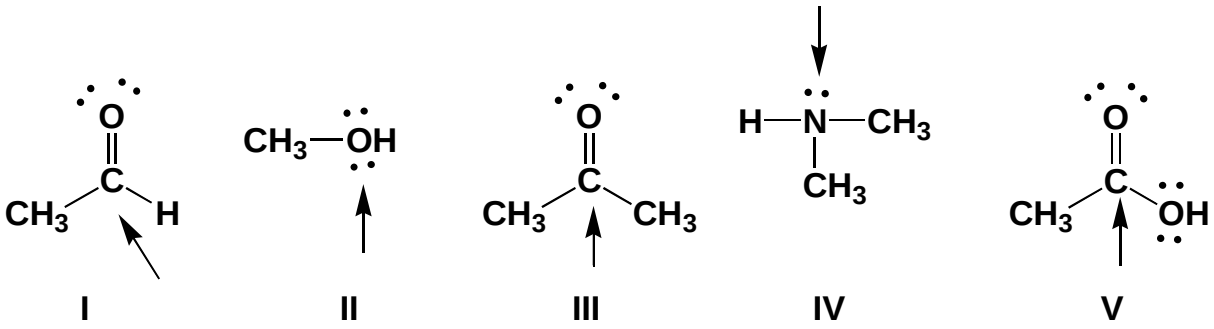
a) II, IV
b) I, IV
c) II, III
d) I, III

Section 1.3
Difficulty Level: Medium
16. Using the VSEPR model, predict which species have bond angles of about 109°.
HINT: Assume that the charges are correct. Add the missing lone pairs before applying the VSEPR theory!

NH_3	CO_2	H_2O	H_3O^+	O_3
I	II	III	IV	V

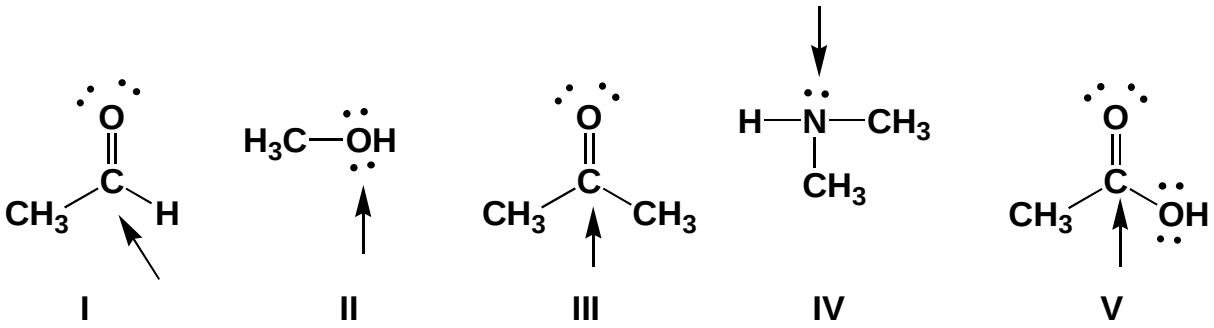
a) I, III, IV
b) II, III, V
c) I, IV
d) III, IV, V

Section 1.3
Difficulty Level: Medium
17: Which of the atoms that are marked with an arrow have tetrahedral geometry?



a) I, II
b) II, IV
c) I, IV, V
d) II, II, V

Section 1.3
Difficulty Level: Medium
18: Which of the atoms that are marked with an arrow are sp^2-hybridized?



a) I, II, III
b) I, II, IV
c) I, III, V
d) III, IV

Section 1.3
Difficulty Level: Hard

19. According to VSEPR model, what is your prediction for the arrangement of electron pairs for CH_3^- ?
    a) linear
    b) tetrahedral
    c) bent
    d) trigonal

Section 1.4
Difficulty Level: Easy
20. Arrange the bonds in increasing order of ionic character (least first).

C-C	Na-O	C-N	O-H	C-O
I	II	III	IV	V

a) III, I, IV, II, V
b) V, III, I, II, IV
c) I, V, III, IV, II
d) I, III, V, IV, II

Section 1.4
Difficulty Level: Easy
21. Nitrogen has a negative formal charge in which of the following compounds?

a) $NaNH_2$
b) N_2
c) NH_4Cl
d) HCN

Section 1.4
Difficulty Level: Easy
22. What is the formal charge of oxygen in H_3O^+?

a) –1
b) 0
c) +1
d) +2

Section 1.4
Difficulty Level: Medium
23. Which compounds contain both covalent and ionic bonds?

CH_3OH	Na_2CO_3	NH_4Cl	NaCl
I	II	III	IV

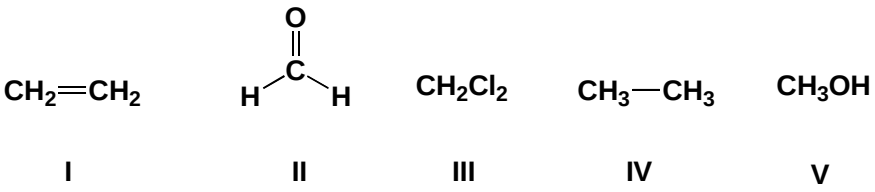
a) I, II
b) II, IV
c) I, II, IV
d) II, III

Section 1.4
Difficulty Level: Medium
24. Which of these molecules are polar?
HINT: look for the presence of at least one polar covalent bond in these molecules!

NH_3	CO_2	H_2O	CH_4	Br_2
I	II	III	IV	V

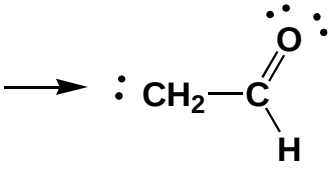
a) I, IV
b) I, III
c) II, III, IV
d) III, IV, V

Section 1.4
Difficulty Level: Medium
25. Which of these molecules are polar?
HINT: look for the presence of at least one polar covalent bond in these molecules!



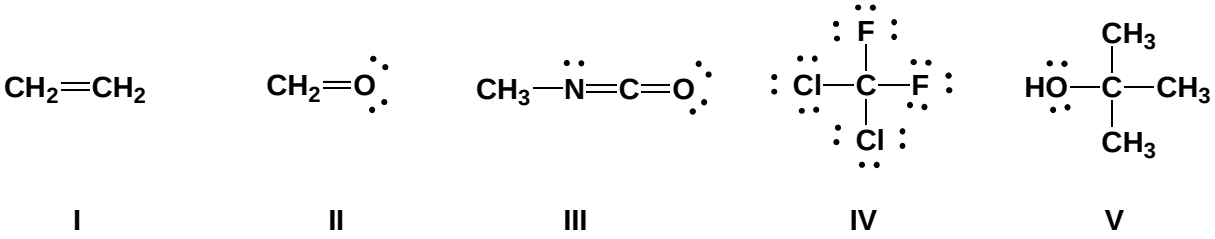
a) III, IV, V
b) I, IV
c) II, III, V
d) I, III

Section 1.4
Difficulty Level: Medium
26. What is the formal charge of indicated carbon in the following molecule? **(HINT: determine the charge first**).



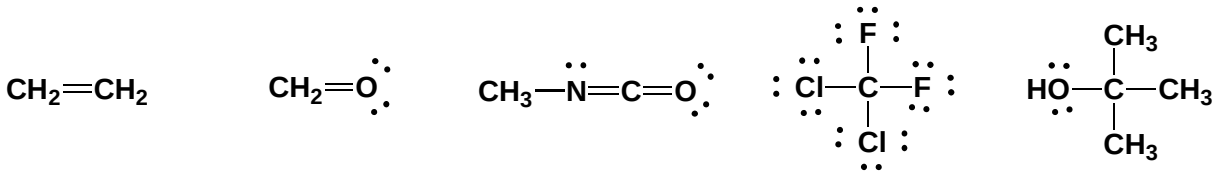
a) –2
b) –1
c) 0
d) +1

Section 1.4
Difficulty Level: Hard
27. Using the VSEPR model, predict which molecules have bond angles of about 109°.
HINT: it is sufficient to discern one atom center in a molecule that has four bonds & lone pairs attached to it.



a) II, IV
b) I, II, III
c) III, IV, V
d) II, III, ,IV

Section 1.4
Difficulty Level: Hard
28. Using the VSEPR model, predict which molecules have bond angles of about 120°.
HINT: it is sufficient to discern one atom center in a molecule that has three bonds & lone pairs attached to it.



I II III IV V

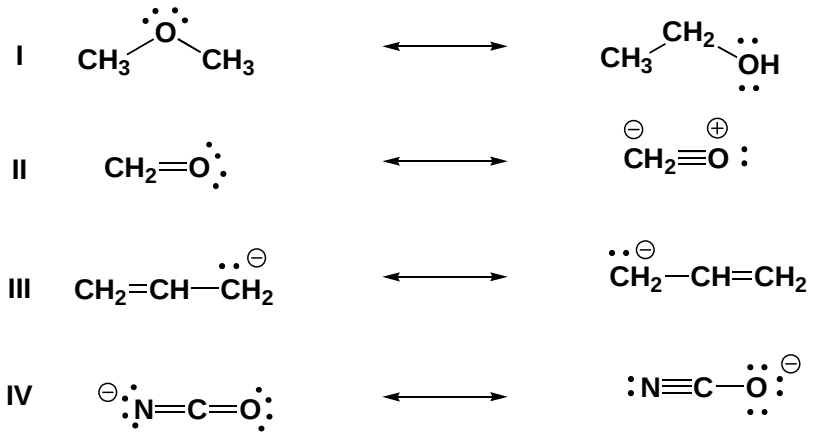
a) I, II, IV
b) I, II, III
c) III, IV, V
d) II, III, ,IV

Section 1.5
Difficulty Level: Medium
29. Which statement about contributing structures is false?

a) All contributing structures must have the same number of valence electrons.
b) All contributing structures must obey the rules of covalent bonding.
c) The position of nuclei may change.
d) Third period atoms may have up to 12 electrons around them.

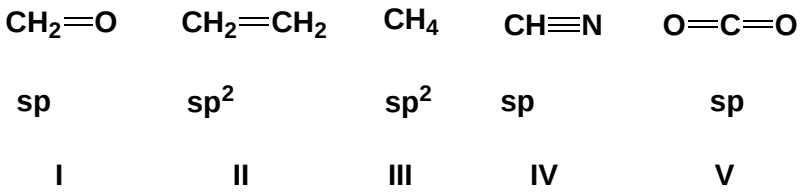
Section 1.5
Difficulty Level: Hard

30. Which of the following are pairs of contributing structures?



a) II, IV
b) I, II, III
c) III, IV
d) II, III, ,IV

Section 1.6
Difficulty Level: Medium
31. The carbon has the correct orbital hybridization in which structures?



a) II, IV, V
b) II, III, IV
c) I, II, III
d) I, IV, V

Section 1.6
Difficulty Level: Medium
32. What are the correct orbital hybridizations for carbon in the following species?
HINT: Add a lone pair if the charge of the molecule suggests it!

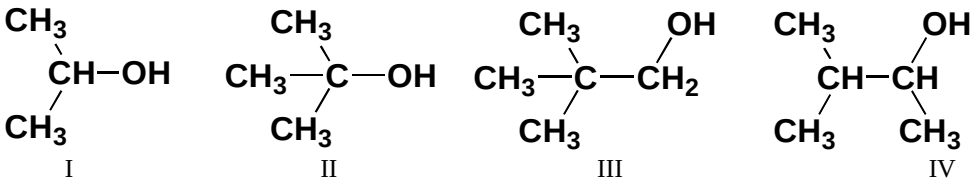
A. $^{\ominus}CH_3$ I. sp

B. CH_4 II. sp^2

C. $^{\oplus}CH_3$ III. sp^3

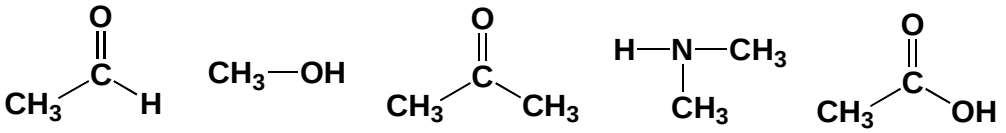
a) A and I, B and III
b) B and I, C and II
c) A and III, C and II
d) A and III, B and III

Section 1.7
Difficulty Level: Easy
33. Which of the following compounds is a tertiary (3°) alcohol?



a) I
b) II
c) III
d) IV

Section 1.7
Difficulty Level: Medium
34. Which compounds are classified correctly?
HINT: Assume that the charges are correct. Add the missing lone pairs!



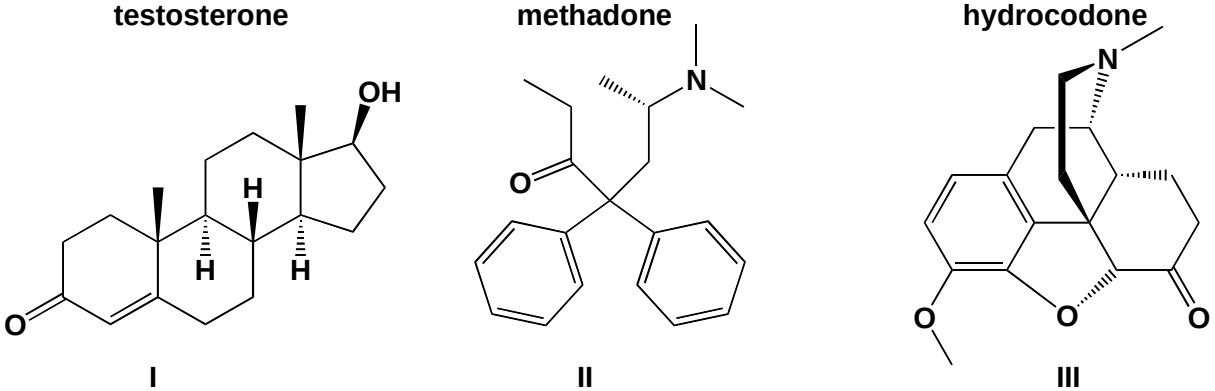
alcohol aldehyde ketone amine carboxylic acid

I **II** **III** **IV** **V**

a) III, IV, V
b) II, III, IV
c) I, III, V
d) I, III, IV

Section 1.7
Difficulty Level: Medium
35. Which of the three molecules testosterone, methadone and hydrocodone contains a ketone?

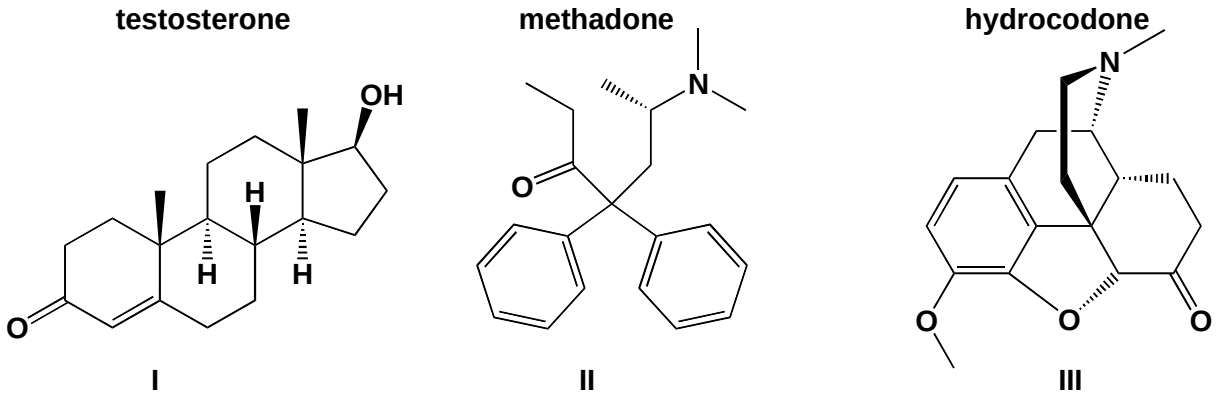
testosterone **methadone** **hydrocodone**



I **II** **III**

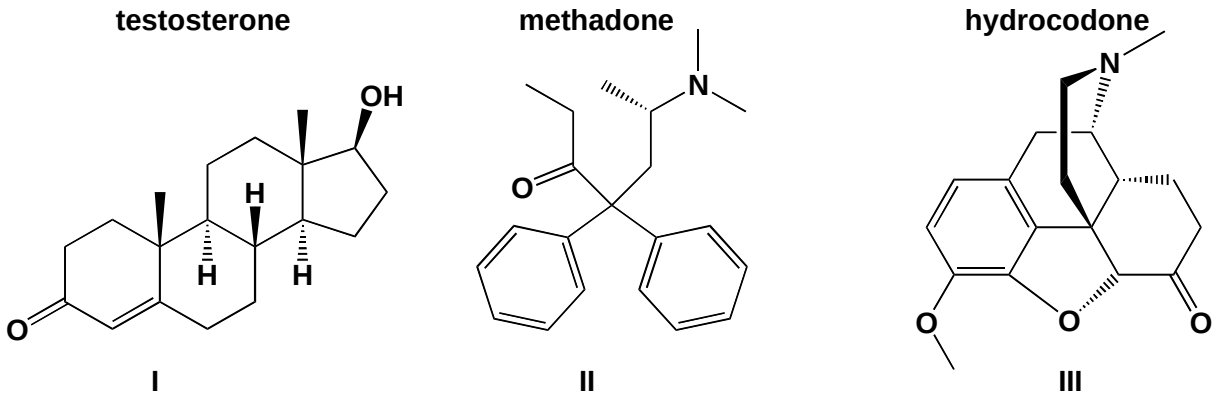
a) I,II
b) III
c) II,III
d) I, II, III

Section 1.7
Difficulty Level: Medium
36. Which of the three molecules testosterone, methadone and hydrocodone contains an amine?



a) I,II
b) III
c) II,III
d) I, II, III

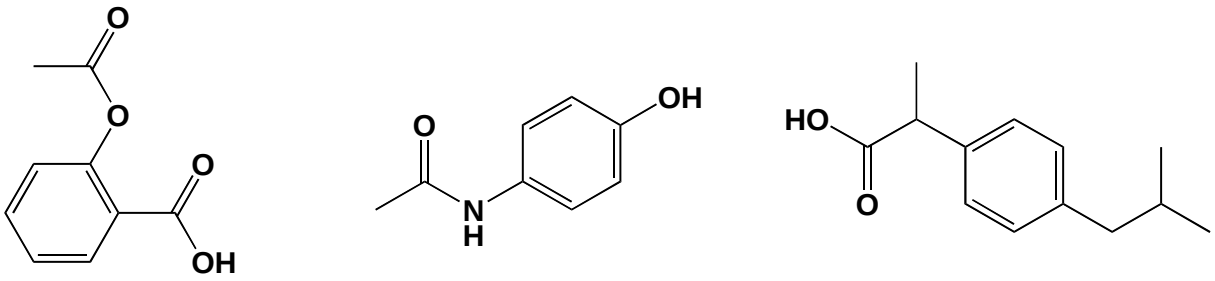
Section 1.7
Difficulty Level: Medium
37. Which of the three molecules testosterone, methadone and hydrocodone contains a hydroxyl group.



a) I
b) I, III
c) II,III
d) I, II, III

Section 1.7
Difficulty Level: Medium
38. Which of the three molecules aspirin, paracetamol and ibuprofen contains a carboxyl group?

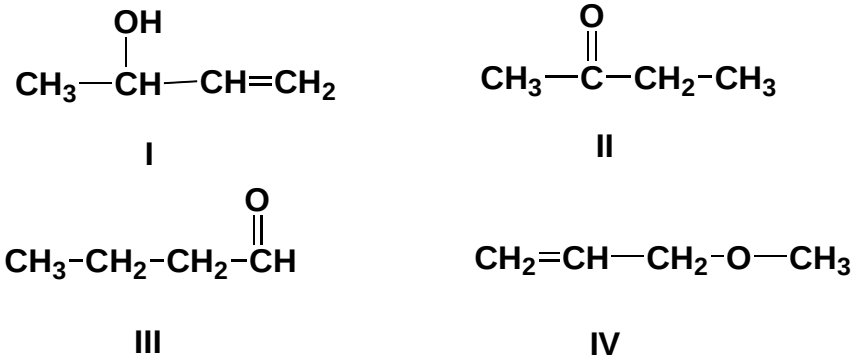
aspirin **paracetamol** **ibuprofen**



I **II** **III**

a) I
b) I, III
c) II,III
d) I, II, III

Section 1.7
Difficulty Level: Hard
39. What is the correct structure for the aldehyde, which has the formula C_4H_8O?
HINT: Assume that the charges are correct. Add the missing lone pairs!



I **II**

III **IV**

a) I
b) II
c) III
d) IV

Fill in the Blank Questions

Section 1.1
Difficulty Level: Easy
1. The spins of the electrons must be _____ in an orbital.

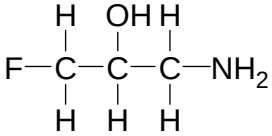
Section 1.1
Difficulty Level: Easy
2. Outer shell electrons are called _____ electrons.

Section 1.1
Difficulty Level: Easy
3. _____ is the number of valence electrons for S.

Section 1.1
Difficulty Level: Easy
4. _____ is the number of valence electrons for Br.

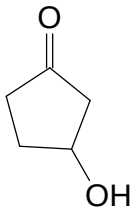
Section 1.1
Difficulty Level: Easy
5. The tendency of an element to react such that it achieves a noble gas configuration is called the _____ _____. (Sec. 1.1, EASY)

Section 1.4
Difficulty Level: Medium
6. The most polar bond in the following molecule is _____.

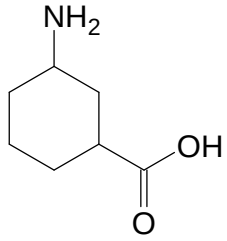


Section 1.4
Difficulty Level: Medium
7. A _____ bond is characterized by the unequal sharing of electrons.

Section 1.7
Difficulty Level: Medium
8. The following molecule contains the _____ and _____ functional groups.



Section 1.7
Difficulty Level: Medium
9. The following molecule contains the _____ and _____ functional groups.



Section 1.7
Difficulty Level: Medium
10. Functional groups undergo the same type of _____ in whatever compound they are found.

Section 1.7
Difficulty Level: Medium
11. _____ are the basis for compound nomenclature.

True-False Questions

Section 1.1
Difficulty Level: Easy
1. Each shell can hold two electrons.

Section 1.1
Difficulty Level: Medium
2. Orbitals make up the majority of the mass of an atom.

Section 1.2
Difficulty Level: Easy
3. An atom that gains electrons is called an anion.

Section 1.2
Difficulty Level: Easy
4. Ionic bonds are characterized by the unequal sharing of electrons.

Section 1.2
Difficulty Level: Medium
5. The group 7A elements react by losing an electron to achieve a noble gas configuration.

Section 1.2
Difficulty Level: Medium
6. The group 2A elements react by losing two electrons to achieve a noble gas configuration.

Section 1.2
Difficulty Level: Medium
7. Carbon reacts by gaining 4 electrons to achieve a noble gas configuration.

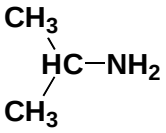
Section 1.4
Difficulty Level: Medium

8. $CH_3CH_2CH_2CH_2CH_2OH$ is a polar molecule.

Section 1.4
Difficulty Level: Medium

9. CH_3ONa contains only polar covalent bonds.

Section 1.7
Difficulty Level: Medium
10. The following molecule is an example of a secondary amine.



Answers

Multiple Choice

1. b
2. c
3. d
4. c
5. b
6. c
7. b
8. c
9. c
10. a
11. a,d
12. c
13. d
14. d
15. d
16. a
17. b
18. c
19. b
20. d
21. a
22. c
23. d
24. b
25. c
26. b
27. c
28. b
29. c
30. c
31. a
32. c,d
33. b
34. a
35. d
36. c
37. a
38. b
39. c

Fill in the Blank Questions

1. paired
2. valence
3. 6
4. 7
5. octet rule
6. C-F
7. polar covalent
8. hydroxyl and carboxyl groups
9. 1° amino and carboxyl groups
10. reactions

11. Functional groups

True-False Questions

1. F
2. F
3. T
4. F
5. F
6. T
7. F
8. T
9. F
10. F