Question #: 1

How many carbon chirality centers are in the molecule below?

A. 1  
B. 2  
C. 3  
D. 4  
E. 5

Question #: 2

Identify the carbon chirality center in the molecule below. Scroll down the page to see the entire molecule.
Question #: 3

Consider the molecule below:

Select two molecules that represent the enantiomer of the molecule above.

A.

B.
Consider the Fischer projection below:

Which statement correctly describes how wedges/dashes are assigned in Fischer projections?

A. Both horizontal and vertical lines in Fischer projections are wedges.
B. Both horizontal and vertical lines in Fischer projections are dashes.
C. Vertical lines are wedges; horizontal lines are dashes.
D. Vertical lines are dashes; horizontal lines are wedges.
Question #: 5

Consider the molecules below:

Identify a pair of diastereomers from the list below:

A. I and II  
B. I and III  
C. I and IV  
D. II and IV

Question #: 6

Classify the indicated functional group as an alcohol, aldehyde, amide, carboxylic acid, ester, ether, or ketone.

Functional Group  

1. ___________
Question #: 7

Classify the indicated functional group as an alcohol, aldehyde, amide, carboxylic acid, ester, ether, or ketone.

![Chemical structure]

Functional Group 1

1. __________

Question #: 8

Classify the indicated functional group as an alcohol, aldehyde, amide, carboxylic acid, ester, ether, or ketone.

![Chemical structure]

Functional Group 1

1. __________
Question #: 9
What is the name of the molecule below?

A. 3-ethyl-4-methyl-1-heptanone
B. 5-ethyl-4-methyl-7-heptanone
C. 3-ethyl-4-methylheptanal
D. 5-ethyl-4-methylheptanal
E. 3-ethyl-4-methylheptanoic acid

Question #: 10
What is the name of the molecule below?

A. 3,4-dimethyl-5-heptanone
B. 4,5-dimethyl-3-heptanone
C. 4,5-dimethylheptanal
D. 3,4-dimethylheptanal
E. ethyl-2,3-dimethylpetanoate
Question #: 11

What is the oxidation product of an aldehyde with potassium dichromate (K$_2$Cr$_2$O$_7$)?

A. primary alcohol
B. secondary alcohol
C. tertiary alcohol
D. ketone
E. carboxylic acid

Question #: 12

The reaction below is fundamental to vision:

Which statement describes what happens during the reaction?

A. The reactant molecule is transformed from a cis to a trans stereoisomer.
B. The reactant molecule is transformed from a trans to a cis stereoisomer.
C. The reactant molecule is reduced from an aldehyde to an alcohol.
D. The reactant molecule is oxidized from an alcohol to an aldehyde.
Question #: 13

Identify a carbon atom contained in an acetal and a hemi-acetal in the appropriate blanks below. Report your answer as C with a number (i.e. C1 or C5).

1. Acetal Carbon (Identify 1 carbon only)
2. Hemi-Acetal Carbon (Identify 1 carbon only)

1. __________
2. __________

Question #: 14

What is the name of the molecule below?

A. methyl hexanoate
B. ethyl pentanoate
C. 4-ethylpentanoic acid
D. 3,4-dimethyl-6-hexanoic acid
E. 3,4-dimethylhexanoic acid
**Question #: 15**

What is the name of the molecule below?

A. ethyl 3-methylhexanoate  
B. methyl hexanoate  
C. 5-ethoxypentanoic acid  
D. ethyl 4-methylhexanote  
E. 1-ethoxypentanoic acid

**Question #: 16**

What is the name of the molecule below?

A. N-methylbutanamide  
B. N-ethylbutanamide  
C. N-ethylbutanoic acid  
D. N-methylbutanoic acid  
E. ethyl butanoate
Rank the following molecules according to boiling point. Enter the letter (A, B, or C) of the compound with the **lowest (1)** and **highest (2)** boiling points.

**lowest boiling point** = 1

**highest boiling point** = 2

1. molecule A

2. molecule B

molecule C
Rank the following molecules according to boiling point. Enter the letter (A, B, or C) of the compound with the lowest (1) and highest (2) boiling points.

**lowest boiling point** = 1
**highest boiling point** = 2

molecule A

molecule B

molecule C

1. _________
2. _________
Rank the following molecules according to boiling point. **Enter the letter [A, B, C]** located next to the name of the compound with the lowest (1) and highest (2) boiling points.

*lowest boiling point = 1*

*highest boiling point = 2*

1. __________
2. __________
Question #: 20

What type of product is formed in the reaction below?

\[
\text{O} + 2 \text{CH}_3\text{CH}_2\text{OH} \rightarrow \text{CH}_3\text{CH}_2\text{COO}^- + \text{H}_2\text{SO}_4
\]

A. amide  
B. acetal  
C. aldehyde  
D. ester  
E. ketone

Question #: 21

Consider the reaction below:

\[
\text{A} + \text{NaOH} \rightarrow \text{C} + \text{Na}^+ + \text{H}_2\text{O}
\]

Which molecule can act as soap?

A. Molecule A  
B. Molecule B  
C. Molecule C  
D. Molecule D  
E. Molecule E
Question #: 22

Which **two** types of organic products are formed in the reaction below?

\[
\text{O} \quad \text{H}_{2}\text{O} \quad \text{HCl} \quad ??????????
\]

A. amide  
B. carboxylic acid  
C. aldehyde  
D. amine salt  
E. alcohol

Question #: 23

What type of linkage is formed when the molecules below are joined (condense) into one product?

\[
\text{H}_2\text{N-} \quad \text{O} \quad \text{H}_2\text{N-} \quad \text{O} \\
+ \quad \text{H}_2\text{N-} \quad \text{OH} \quad \text{H}_2\text{N-} \quad \text{OH}
\]

A. amide  
B. carboxylic acid  
C. aldehyde  
D. amine salt  
E. alcohol
Question #: 24

Which two reactions will produce a carboxylate salt?

A. 

B. 

C. 

D. 

E. 

Question #: 25

Which combination will exclusively shift reaction equilibrium to the right?

A. Increase the alcohol concentration; increase the water concentration.
B. Decrease the alcohol concentration; decrease the water concentration.
C. Increase the alcohol concentration; decrease the water concentration.
D. Decrease the alcohol concentration; increase the water concentration.
How many carbon chirality centers are in the molecule below?

A. 1  
B. 2  
C. 3  
D. 4
Question #: 2

Identify the carbon chirality center in the molecule below. Scroll down the page to see the entire molecule.

A. C1
B. C2
C. C3
D. C4
E. C5
F. C6
G. C7
H. C8
✓I. C9
J. C10

Question #: 3

Consider the molecule below:
Select two molecules that represent the **enantiomer** of the molecule above.

✓ A.

✓ C.

Consider the Fischer projection below:
Which statement correctly describes how wedges/dashes are assigned in Fischer projections?

A. Both horizontal and vertical lines in Fischer projections are wedges.
B. Both horizontal and vertical lines in Fischer projections are dashes.
C. Vertical lines are wedges; horizontal lines are dashes.
D. Vertical lines are dashes; horizontal lines are wedges.

✓ D. Vertical lines are dashes; horizontal lines are wedges.

Consider the molecules below:

Identify a pair of diastereomers from the list below:

✓ A. I and II
B. I and III
C. I and IV
D. II and IV

Classify the indicated functional group as an alcohol, aldehyde, amide, carboxylic acid, ester, ether, or ketone.

alcohol, aldehyde, amide, carboxylic acid, ester, ether, or ketone.
Functional Group  __1__

1. aldehyde

---

**Question #**: 7

Classify the indicated functional group as an **alcohol, aldehyde, amide, carboxylic acid, ester, ether**, or **ketone**.

---

Functional Group  __1__

1. ester

---

**Question #**: 8

Classify the indicated functional group as an **alcohol, aldehyde, amide, carboxylic acid, ester, ether**, or **ketone**.
Functional Group 1

1. amide

---

**Question #:** 9

What is the name of the molecule below?

A. 3-ethyl-4-methyl-1-heptanone
B. 5-ethyl-4-methyl-7-heptanone
C. 3-ethyl-4-methylheptanal
D. 5-ethyl-4-methylheptanal
E. 3-ethyl-4-methylheptanoic acid

---

**Question #:** 10

What is the name of the molecule below?
A. 3,4-dimethyl-5-heptanone
✓ B. 4,5-dimethyl-3-heptanone
 C. 4,5-dimethylheptanal
 D. 3,4-dimethylheptanal
 E. ethyl-2,3-dimethylpetanoate

Question #: 11

What is the oxidation product of an aldehyde with potassium dichromate (K₂Cr₂O₇)?

A. primary alcohol
B. secondary alcohol
C. tertiary alcohol
D. ketone
✓ E. carboxylic acid

Question #: 12

The reaction below is fundamental to vision:

Which statement describes what happens during the reaction?
A. The reactant molecule is transformed from a cis to a trans stereoisomer.
B. The reactant molecule is transformed from a trans to a cis stereoisomer.
C. The reactant molecule is reduced from an aldehyde to an alcohol.
D. The reactant molecule is oxidized from an alcohol to an aldehyde.

Question #: 13

Identify a carbon atom contained in an acetal and a hemi-acetal in the appropriate blanks below. Report your answer as C with a number (i.e. C1 or C5).

1. Acetal Carbon (Identify 1 carbon only)
2. Hemi-Acetal Carbon (Identify 1 carbon only)

1. C6|C7|
2. C10|C10|

Question #: 14

What is the name of the molecule below?
Question #: 15

What is the name of the molecule below?

- A. methyl hexanoate
- B. ethyl pentanoate
- C. 4-ethylpentanoic acid
- D. 3,4-dimethyl-6-hexanoic acid
- ✓ E. 3,4-dimethylhexanoic acid

Question #: 16

✓ A. ethyl 3-methylhexanoate
- B. methyl hexanoate
- C. 5-ethoxypentanoic acid
- D. ethyl 4-methylhexanote
- E. 1-ethoxypentanoic acid
What is the name of the molecule below?

A. N-methylbutanamide  
✓ B. N-ethylbutanamide  
C. N-ethylbutanoic acid  
D. N-methylbutanoic acid  
E. ethyl butanoate

**Question #: 17**

Rank the following molecules according to boiling point. Enter the letter (A, B, or C) of the compound with the **lowest** (1) and **highest** (2) boiling points.

**lowest boiling point** = 1

**highest boiling point** = 2

molecule A

molecule B
Question #: 18

Rank the following molecules according to boiling point. Enter the letter (A, B, or C) of the compound with the **lowest** (1) and **highest** (2) boiling points.

**lowest boiling point =**  
**highest boiling point =**

molecule A

molecule B

molecule C

1. A
2. B

Question #: 19
Rank the following molecules according to boiling point. Enter the letter [A, B, C] located next to the name of the compound with the lowest (1) and highest (2) boiling points.

lowest boiling point = 1
highest boiling point = 2

isobutanamide (A)

N-methylpropanamide (B)

N,N-dimethylethanamide (C)

1. C[(C)|N,N-dimethylethanamide|
2. A[(A)|isobutanamide|

Question #: 20

What type of product is formed in the reaction below?
Question #: 21

Consider the reaction below:

\[ \text{A. amide} \]
\[ \text{✓ B. acetal} \]
\[ \text{C. aldehyde} \]
\[ \text{D. ester} \]
\[ \text{E. ketone} \]

Which molecule can act as soap?

A. Molecule A
B. Molecule B
✓ C. Molecule C
D. Molecule D
E. Molecule E

Question #: 22

Which two types of organic products are formed in the reaction below?

\[ \text{A. amide} \]
\[ \text{✓ B. carboxylic acid} \]
\[ \text{C. aldehyde} \]
\[ \text{✓ D. amine salt} \]
\[ \text{E. alcohol} \]
Question #: 23

What type of linkage is formed when the molecules below are joined (condense) into one product?

\[
\text{H}_2\text{N}-\text{C}-\text{O} + \text{H}_2\text{N}-\text{C}-\text{O} \quad \leftrightarrow \quad \text{H}_2\text{N}-\text{C}-\text{O}-\text{C}-\text{O}-\text{N}-\text{H}
\]

✓ A. amide  
   B. carboxylic acid  
   C. aldehyde  
   D. amine salt  
   E. alcohol

Question #: 24

Which two reactions will produce a carboxylate salt?

A.  
   \[
   \text{H}_2\text{O} + \text{H}_2\text{SO}_4 \quad \leftrightarrow \quad \text{H}_2\text{O} - \text{SO}_4^-
   \]

✓ B.  
   \[
   \text{H}_2\text{O} + \text{NaOH} \quad \leftrightarrow \quad \text{H}_2\text{O} - \text{O}^-\text{Na}^+
   \]

C.  
   \[
   \text{H}_2\text{O} + \text{HCl} \quad \leftrightarrow \quad \text{H}_2\text{O} - \text{Cl}^-
   \]

✓ D.  
   \[
   \text{H}_2\text{O} + \text{NaOH} \quad \leftrightarrow \quad \text{H}_2\text{O} - \text{O}^-\text{Na}^+
   \]
Question #: 25

Which combination will exclusively shift reaction equilibrium to the right?

A. Increase the alcohol concentration; increase the water concentration.
B. Decrease the alcohol concentration; decrease the water concentration.
C. Increase the alcohol concentration; decrease the water concentration.
✓ D. Decrease the alcohol concentration; increase the water concentration.