Question #: 1

When is it permissible to have food or drink in the laboratory?

A. When the food or drink is stored in my backpack.  
B. Food and drink are never permissible in the lab.  
C. Only water is allowed in the lab.  
D. As long as my TA does not see me eat or drink, I can have it in the lab.

Question #: 2

Safety glasses do not provide effective protection against ______.

A. wood splinters  
B. splashes and fumes  
C. finger pokes  
D. flying glass

Question #: 3

When are you required to wear goggles in the laboratory?

A. Only when you are using dangerous chemicals.  
B. When your TA is watching you.  
C. When you feel like wearing them.  
D. When anyone in the lab is using chemicals or glassware.

Question #: 4

What is the molecular formula for a compound that is 46.16% carbon, 5.16% hydrogen and 48.68% fluorine by mass if the molar mass of this compound is 156.12 g?

A. C₃H₄F₂  
B. C₅H₁₀F₅  
C. C₆H₆F₄  
D. C₆H₆F₃
Question #: 5

Space crafts and submarines use lithium hydroxide to capture exhaled carbon dioxide based on the reaction:

\[
2 \text{LiOH} + \text{CO}_2 \rightarrow \text{Li}_2\text{CO}_3 + \text{H}_2\text{O}
\]

If a submarine can hold 5.39 kg of LiOH, what mass of LiOH will be left over if 4 people are on the submarine for one day? One person exhales about 1000 g CO₂ per day.

A. 1.03 kg  
B. 4.95 kg  
C. 9.52 kg  
D. There is not enough LiOH for 4 people

Question #: 6

A stock solution of HCl is standardized by titrating a pure 0.3056 g sample of dry sodium carbonate. The titration required 30.20 mL of the HCl solution. What is the concentration of the HCl solution?

A. 0.005769 M  
B. 0.09553 M  
C. 0.1909 M  
D. 0.01751 M

Question #: 7

Which of the following is the correct net ionic equation for the reaction between Ba(OH)₂ and H₂SO₄?

A. Ba²⁺ (aq) + SO₄²⁻ (aq) → BaSO₄ (aq)  
B. OH⁻ (aq) + H⁺ (aq) → H₂O (l)  
C. Ba²⁺ (aq) + SO₄²⁻ (aq) → BaSO₄ (s)  
D. Ba²⁺ (aq) + OH⁻ (aq) + 2H⁺ (aq) + SO₄²⁻ (aq) → BaSO₄ (s) + 2H₂O(l)
**Question #**: 8

A student trying to determine the concentration of phosphate in an unknown solution produced the following standard curve. The absorbance of the unknown solution was 0.268. What is the concentration of phosphate in the unknown solution?

![Absorbance vs. Concentration](image)

A. 4.10 ppm  
B. 4.49 ppm  
C. 26.8 ppm  
D. 0.00442 ppm

**Question #**: 9

Which of the following provides a format for organizing information about your source material?

A. dictionary  
B. thesaurus  
C. style manual  
D. bibliography

**Question #**: 10

Which of the following components are typically included when citing a journal article? Select all 5 that apply.

A. abstract  
B. volume/issue number  
C. year of publication  
D. name of journal  
E. page numbers  
F. conclusions  
G. authors  
H. discussion  
I. instrumentation
Question #: 11

Identify the following items as plagiarism or not plagiarism. Write out the full words, "plagiarism" or "not plagiarism". Do not abbreviate words.
1.) copying a friend's lab data __1__
2.) writing down your own thoughts __2__
3.) paraphrasing text from a book without a citation __3__
4.) quoting material from a book and including a citation __4__

1. __________
2. __________
3. __________
4. __________

Question #: 12

Review the original material and the student work below. Which type of plagiarism was committed, if any?

Original Material
- "Lipids are the chemical components of the cell that are insoluble in water but soluble in non-polar solvents. One type of lipid is the fatty acid, a carboxylic acid with a long hydrocarbon tail." Tro, Nivaldo, J. Chemistry: A Molecular Approach. Boston: Pearson, 2014. Print. p. 1002.

Student Work
- Fatty acid is one type of lipid, consisting of a carboxylic acid with a long hydrocarbon tail. Lipids are insoluble in water but soluble in non-polar solvents and are the chemical components of the cell (Tro, 1002).

A. not plagiarism
B. mosaic plagiarism
C. direct plagiarism

Question #: 13

How many electron groups are predicted by the VSEPR rules to be present on the sulfur atom of SBr₂?

A. 2
B. 3
C. 4
D. 5
**Question #:** 14

What is the predicted molecular geometry of phosphorus in PCl₃?

A. trigonal pyramidal
B. tetrahedral
C. trigonal bipyramidal
D. trigonal planar

**Question #:** 15

Which of the following correctly pairs the chemical formula with the total number of valence electrons?

A. COCl₂, 20 e⁻
B. OF₂, 18 e⁻
C. SeF₂, 50 e⁻
D. CH₃NH₂, 14 e⁻

**Question #:** 16

SO₂ has the same electron pair geometry as ______.

A. NH₃
B. O₃
C. CO₂
D. H₂O

**Question #:** 17

What is the electron geometry of the carbon atom in CH₂Cl₂?

A. trigonal planar
B. tetrahedral
C. trigonal bipyramidal
D. octahedral
Question #: 18

What is the hybridization of the oxygen atom labeled y in the structure shown below?

\[\text{\[
\begin{array}{cccc}
\text{H} & \text{H} & \text{O} & \text{x} \\
\text{H} & \text{C} & \text{C} & \text{C} \\
\text{H} & \text{C} & \text{H} & \text{Y} \\
\text{H} & & & \\
\text{H} & & & \\
\end{array}
\]}
\]

A. \(sp^3\)
B. \(sp^2\)
C. \(sp\)
D. \(sp^3d\)

Question #: 19

In general, as the concentration of a nonvolatile solute in an aqueous solution increases, the freezing point of the solution ____ and the boiling point of the solution ____.

A. increases, increases
B. decreases, increases
C. increases, decreases
D. decreases, decreases

Question #: 20

What mass of ethylene glycol (antifreeze, MW = 62.1 g/mol) must be added to 10.0 liters of water to produce a solution that freezes at –23.3 °C? The density of water is 1.00 g/mL and \(K_f = 1.86 \, ^\circ\text{C}/m\).

A. 7.78 kg
B. 26.9 kg
C. 0.406 kg
D. 12.5 kg
Question #: 21

A student determined that the average $K_f$ value over her four sugar solutions was 3.30 °C/m. The literature states that the $K_f$ for water is 1.86 °C/m. What is the student’s minimum percent error?

A. 77.4 %
B. 177 %
C. 56.4 %
D. 2.68 %

Question #: 22

Which of the following 0.03 $m$ aqueous solutions has the lowest freezing point?

A. glucose
B. AlBr$_3$
C. CaBr$_2$
D. NaBr

Question #: 23

Which aqueous solution will have the lowest freezing point?

A. 0.030 $m$ glucose
B. 0.030 $m$ AlBr$_3$
C. 0.030 $m$ CaBr$_2$
D. 0.030 $m$ NaBr
A student prepared a sugar solution containing 1.3658 g of sugar (C$_{12}$H$_{22}$O$_{11}$) in 25.00 mL of water, and he/she produced the following freezing point curves. What is the $K_f$ of water based on the student's data?

A. 230 ºC/m
B. 1.8 ºC/m
C. 0.041 ºC/m
D. 24 ºC/m
Question #: 25

If 355 g of ethanol (C₂H₅OH) is added to 645 g of water, what is the molality of the ethanol solution?

A. 0.550 m  
B. 7.71 m  
C. 11.9 m  
D. 21.7 m

Question #: 26

The activation energy for the following first-order reaction is 102 kJ/mol.

\[ 2 \text{N}_2\text{O}_5 (g) \rightarrow 4 \text{NO}_2 (g) + \text{O}_2 (g) \]

The value of the rate constant, \( k \), is \(1.35 \times 10^{-4} \text{s}^{-1} \) at 35 °C. What is the value of \( k \) at 0°C?

A. \(8.2 \times 10^{-7} \text{s}^{-1}\)  
B. \(1.9 \times 10^{-5} \text{s}^{-1}\)  
C. \(4.2 \times 10^{-5} \text{s}^{-1}\)  
D. \(2.2 \times 10^{-2} \text{s}^{-1}\)

Question #: 27

What is the purpose of measuring the pressure when determining the activation energy of the decomposition of hydrogen peroxide?

A. To be able to determine the change in temperature.  
B. To measure the gas constant.  
C. To dilute the hydrogen peroxide solution.  
D. To determine the change in concentration of the gas being produced.
In order to determine the rate law for the decomposition of hydrogen peroxide, a student collected pressure versus time measurements as the hydrogen peroxide decomposed with the addition of KI. The following graph was produced at 21.3 °C. What is the rate of formation of O₂?

\[ \frac{\text{mol}}{\text{L} \times \text{s}} \]

A. 0.0858
B. 2.07
C. \(1.13 \times 10^{-4}\)
D. 11.7
Question #: 29

Nitric oxide (NO) reacts with chlorine according to the equation:

\[ 2 \text{NO}(g) + \text{Cl}_2(g) \rightarrow 2 \text{NOCl}(g) \]

These initial reaction rates were measured for the given reagent concentrations.

<table>
<thead>
<tr>
<th>Experiment #</th>
<th>[NO] (M)</th>
<th>[Cl}_2] (M)</th>
<th>Rate (M/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.50</td>
<td>0.50</td>
<td>1.19</td>
</tr>
<tr>
<td>2</td>
<td>1.00</td>
<td>0.50</td>
<td>4.79</td>
</tr>
<tr>
<td>3</td>
<td>1.00</td>
<td>1.00</td>
<td>9.59</td>
</tr>
</tbody>
</table>

Which of the following is the rate law for this reaction?

A. \( \text{rate} = k[\text{NO}] \)
B. \( \text{rate} = k[\text{NO}][\text{Cl}_2]^{1/2} \)
C. \( \text{rate} = k[\text{NO}][\text{Cl}_2] \)
D. \( \text{rate} = k[\text{NO}]^2[\text{Cl}_2] \)

Question #: 30

Consider the reaction

A + 2B →products

This reaction was found to have the rate law, \( \text{rate} = k[A][B]^2 \). The concentration of A was held constant and the concentration of B was increased by a factor of 3. By what factor will the rate of reaction increase?

A. 3
B. 6
C. 9
D. 27
Question #: 1

When is it permissible to have food or drink in the laboratory?

A. When the food or drink is stored in my backpack.  
✓ B. Food and drink are never permissible in the lab.  
C. Only water is allowed in the lab.  
D. As long as my TA does not see me eat or drink, I can have it in the lab.

Question #: 2

Safety glasses do not provide effective protection against ______.

A. wood splinters  
✓ B. splashes and fumes  
C. finger pokes  
D. flying glass

Question #: 3

When are you required to wear goggles in the laboratory?

A. Only when you are using dangerous chemicals.  
B. When your TA is watching you.  
C. When you feel like wearing them.  
✓ D. When anyone in the lab is using chemicals or glassware.

Question #: 4

What is the molecular formula for a compound that is 46.16% carbon, 5.16% hydrogen and 48.68% fluorine by mass if the molar mass of this compound is 156.12 g?

A. C₃H₄F₂  
B. C₅H₁₀F₅  
✓ C. C₆H₈F₄  
D. C₆H₆F₃
**Question #: 5**

Space crafts and submarines use lithium hydroxide to capture exhaled carbon dioxide based on the reaction: \[ 2 \text{LiOH} + \text{CO}_2 \rightarrow \text{Li}_2\text{CO}_3 + \text{H}_2\text{O} \]

If a submarine can hold 5.39 kg of LiOH, what mass of LiOH will be left over if 4 people are on the submarine for one day? One person exhales about 1000 g CO\(_2\) per day.

- A. 1.03 kg
- B. 4.95 kg
- C. 9.52 kg
- D. There is not enough LiOH for 4 people

**Question #: 6**

A stock solution of HCl is standardized by titrating a pure 0.3056 g sample of dry sodium carbonate. The titration required 30.20 mL of the HCl solution. What is the concentration of the HCl solution?

- A. 0.005769 M
- B. 0.09553 M
- C. 0.1909 M
- D. 0.01751 M

**Question #: 7**

Which of the following is the correct net ionic equation for the reaction between Ba(OH)\(_2\) and H\(_2\)SO\(_4\)?

- A. \( \text{Ba}^{2+} (aq) + \text{SO}_4^{2-} (aq) \rightarrow \text{BaSO}_4 (aq) \)
- B. \( \text{OH}^- (aq) + \text{H}^+ (aq) \rightarrow \text{H}_2\text{O} (l) \)
- C. \( \text{Ba}^{2+} (aq) + \text{SO}_4^{2-} (aq) \rightarrow \text{BaSO}_4 (s) \)
- D. \( \text{Ba}^{2+} (aq) + \text{OH}^- (aq) + 2\text{H}^+ (aq) + \text{SO}_4^{2-} (aq) \rightarrow \text{BaSO}_4 (s) + 2\text{H}_2\text{O}(l) \)
Question #: 8

A student trying to determine the concentration of phosphate in an unknown solution produced the following standard curve. The absorbance of the unknown solution was 0.268. What is the concentration of phosphate in the unknown solution?

![Absorbance vs. Concentration graph]

A. 4.10 ppm
✓B. 4.49 ppm
C. 26.8 ppm
D. 0.00442 ppm

Question #: 9

Which of the following provides a format for organizing information about your source material?

A. dictionary
B. thesaurus
✓C. style manual
D. bibliography

Question #: 10

Which of the following components are typically included when citing a journal article? Select all 5 that apply.

A. abstract
✓B. volume/issue number
✓C. year of publication
✓D. name of journal
✓E. page numbers
F. conclusions
✓G. authors
H. discussion
I. instrumentation
Question #: 11

Identify the following items as plagiarism or not plagiarism. Write out the full words, "plagiarism" or "not plagiarism". Do not abbreviate words.

1.) copying a friend's lab data _1_
2.) writing down your own thoughts _2_
3.) paraphrasing text from a book without a citation _3_
4.) quoting material from a book and including a citation _4_

1. plagiarism
2. not plagiarism
3. plagiarism
4. not plagiarism

Question #: 12

Review the original material and the student work below. Which type of plagiarism was committed, if any?

Original Material
• "Lipids are the chemical components of the cell that are insoluble in water but soluble in non-polar solvents. One type of lipid is the fatty acid, a carboxylic acid with a long hydrocarbon tail."  Tro, Nivaldo, J. Chemistry: A Molecular Approach. Boston: Pearson, 2014. Print. p. 1002.

Student Work
• Fatty acid is one type of lipid, consisting of a carboxylic acid with a long hydrocarbon tail. Lipids are insoluble in water but soluble in non-polar solvents and are the chemical components of the cell (Tro, 1002).

A. not plagiarism
✓B. mosaic plagiarism
C. direct plagiarism

Question #: 13

How many electron groups are predicted by the VSEPR rules to be present on the sulfur atom of SBr₂?

A. 2
B. 3
✓C. 4
D. 5
Question #: 14

What is the predicted molecular geometry of phosphorus in PCl₃?

✓ A. trigonal pyramidal
   B. tetrahedral
   C. trigonal bipyramidal
   D. trigonal planar

Question #: 15

Which of the following correctly pairs the chemical formula with the total number of valence electrons?

A. COCl₂, 20 e⁻
B. OF₂, 18 e⁻
C. SeF₂, 50 e⁻
✓ D. CH₃NH₂, 14 e⁻

Question #: 16

SO₂ has the same electron pair geometry as ______.

A. NH₃
✓ B. O₃
C. CO₂
D. H₂O

Question #: 17

What is the electron geometry of the carbon atom in CH₂Cl₂?

A. trigonal planar
✓ B. tetrahedral
C. trigonal bipyramidal
D. octahedral
Question #: 18

What is the hybridization of the oxygen atom labeled y in the structure shown below?

\[ \text{H} \quad \text{H} \quad \text{O} \quad \text{x} \]
\[ \text{H} \quad \text{C} \quad \text{C} \quad \text{O} \quad \text{H} \]
\[ \text{H} \quad \text{C} \quad \text{C} \quad \text{H} \quad \text{y} \]
\[ \text{H} \]

A. \( sp^3 \)
B. \( sp^2 \)
C. \( sp \)
D. \( sp^3d \)

Question #: 19

In general, as the concentration of a nonvolatile solute in an aqueous solution increases, the freezing point of the solution ____ and the boiling point of the solution ____.

A. increases, increases
✓B. decreases, increases
C. increases, decreases
D. decreases, decreases

Question #: 20

What mass of ethylene glycol (antifreeze, MW = 62.1 g/mol) must be added to 10.0 liters of water to produce a solution that freezes at –23.3 °C? The density of water is 1.00 g/mL and \( K_f = 1.86 \, ^\circ C/m \).

A. 7.78 kg
✓B. 26.9 kg
C. 0.406 kg
D. 12.5 kg
Question #: 21

A student determined that the average $K_f$ value over her four sugar solutions was 3.30 °C/m. The literature states that the $K_f$ for water is 1.86 °C/m. What is the student’s minimum percent error?

✓ A. 77.4 %
B. 177 %
C. 56.4 %
D. 2.68 %

Question #: 22

Which of the following 0.03 $m$ aqueous solutions has the lowest freezing point?

A. glucose
✓ B. AlBr₃
C. CaBr₂
D. NaBr

Question #: 23

Which aqueous solution will have the lowest freezing point?

A. 0.030 $m$ glucose
✓ B. 0.030 $m$ AlBr₃
C. 0.030 $m$ CaBr₂
D. 0.030 $m$ NaBr
A student prepared a sugar solution containing 1.3658 g of sugar (C\textsubscript{12}H\textsubscript{22}O\textsubscript{11}) in 25.00 mL of water, and he/she produced the following freezing point curves. What is the $K_f$ of water based on the student's data?

A. 230 °C/m  
B. 1.8 °C/m  
C. 0.041 °C/m  
D. 24 °C/m  

Correct answer: D. 24 °C/m
Question #: 25

If 355 g of ethanol (C₂H₅OH) is added to 645 g of water, what is the molality of the ethanol solution?

- A. 0.550 m
- B. 7.71 m
- C. 11.9 m
- D. 21.7 m

Question #: 26

The activation energy for the following first-order reaction is 102 kJ/mol.

\[ 2 \text{N}_2\text{O}_5 (g) \rightarrow 4 \text{NO}_2 (g) + \text{O}_2 (g) \]

The value of the rate constant, \( k \), is \(1.35 \times 10^{-4} \text{ s}^{-1} \) at 35°C. What is the value of \( k \) at 0°C?

- A. \(8.2 \times 10^{-7} \text{ s}^{-1}\)
- B. \(1.9 \times 10^{-5} \text{ s}^{-1}\)
- C. \(4.2 \times 10^{-5} \text{ s}^{-1}\)
- D. \(2.2 \times 10^{-2} \text{ s}^{-1}\)

Question #: 27

What is the purpose of measuring the pressure when determining the activation energy of the decomposition of hydrogen peroxide?

- A. To be able to determine the change in temperature.
- B. To measure the gas constant.
- C. To dilute the hydrogen peroxide solution.
- D. To determine the change in concentration of the gas being produced.
In order to determine the rate law for the decomposition of hydrogen peroxide, a student collected pressure versus time measurements as the hydrogen peroxide decomposed with the addition of KI. The following graph was produced at $21.3 \, ^\circ\text{C}$. What is the rate of formation of $\text{O}_2$?

\[ y = 2.07x + 29.679 \]

\[ R^2 = 0.9628 \]

\[
\begin{array}{|c|}
\hline
\text{mol} & \text{L} \times \text{s} \\
\hline
\text{A.} & 0.0858 \\
\text{B.} & 2.07 \\
\text{C.} & 1.13 \times 10^{-4} \\
\text{D.} & 11.7 \\
\hline
\end{array}
\]
Nitric oxide (NO) reacts with chlorine according to the equation:

\[ 2 \text{NO}(g) + \text{Cl}_2(g) \rightarrow 2 \text{NOCl}(g) \]

These initial reaction rates were measured for the given reagent concentrations.

<table>
<thead>
<tr>
<th>Experiment #</th>
<th>[NO] (M)</th>
<th>[Cl(_2)] (M)</th>
<th>Rate (M/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.50</td>
<td>0.50</td>
<td>1.19</td>
</tr>
<tr>
<td>2</td>
<td>1.00</td>
<td>0.50</td>
<td>4.79</td>
</tr>
<tr>
<td>3</td>
<td>1.00</td>
<td>1.0</td>
<td>9.59</td>
</tr>
</tbody>
</table>

Which of the following is the rate law for this reaction?

A. \( \text{rate} = k[\text{NO}] \)
B. \( \text{rate} = k[\text{NO}][\text{Cl}_2]^{1/2} \)
C. \( \text{rate} = k[\text{NO}][\text{Cl}_2] \)
\( \checkmark \) D. \( \text{rate} = k[\text{NO}]^2[\text{Cl}_2] \)

---

Consider the reaction

\[ \text{A} + 2\text{B} \rightarrow \text{products} \]

This reaction was found to have the rate law, \( \text{rate} = k[\text{A}][\text{B}]^2 \). The concentration of A was held constant and the concentration of B was increased by a factor of 3. By what factor will the rate of reaction increase?

A. 3
B. 6
\( \checkmark \) C. 9
D. 27