Question #: 1

Properly and clearly labeling chemicals in containers helps to reduce

A. putting stoppers on containers.
B. waste of paper.
✓ C. cross-contamination.
D. evaporation.

Question #: 2

Vented safety goggles are required in the lab because they provide effective protection against ______.

A. wood splinters
✓ B. splashes and fumes
C. finger pokes
D. smashed fingers
Question #: 3

4.50 g of HCl are reacted with 15.0 g of CaCO₃ following

$$2\text{HCl} + \text{CaCO}_3 \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$$

If 2.50 g of CO₂ is isolated after the reaction, what is the percent yield of CO₂?

1 %

Report your answer to 3 significant figures. Do NOT include the units in your response.

1. 92.1 | 92.2 | 92.3

Question #: 4

What is the net ionic equation for the reaction between the reagents in aqueous solution shown below?

magnesium nitrate + sodium carbonate

Complete the table shown below with your response, starting with the cation as substance 1.

Do NOT balance the reaction. Enter ionic charges without superscripts; e.g., Ca²⁺. All parentheses must be used correctly in chemical formulas.

1. Mg²⁺ | Mg²⁺⁺ | Mg⁺⁺⁺ | Mg⁺⁺⁺⁺ | Mg²⁺ | Mg⁺⁺⁺⁺
2. aq | (aq) | aqueous |
3. CO₃²⁻ | CO₃⁻⁻ | carbonate | Carbonate |
4. aq | (aq) | aqueous |
5. MgCO₃ | magnesium carbonate |
6. s | solid |

Attachment:

attachment_for_itemid_3516.JPG

Question #: 5
Select 3 that apply. You are plagiarizing if you...

✓ A. buy a paper from an Internet site, another student or writing, or any other source and pass it off as your own.
✓ B. turn in a paper that someone else has written, whether the person has given it to you, you've downloaded it from the Internet, or you've copied it from any other source.
✓ C. change selected parts of an existing paper and claim the paper as your own.
D. measured data experimentally in the lab yourself.
E. provided citations for paraphrased material used in your paper.
F. created ideas of your own, synthesizing and citing material from other sources.

Question #: 6

Below is an excerpt from the article: Schuetze, P. (2004). Evaluation of a brief homework assignment designed to reduce citations problems. Teaching of Psychology, 31, 257-259:

“Increased student confidence in their ability to avoid plagiarism would hypothetically result in an inaccurate perception that they are fully knowledgeable about the complexities involved in proper citations in scientific papers” (p. 259).

Which example correctly paraphrases the above passage (i.e. without plagiarizing)?

A. Increased student confidence in their ability to avoid plagiarism would hypothetically result in an inaccurate perception that they are fully knowledgeable about the complexities involved in proper citations in scientific papers (2004).
✓ B. One danger that arises from learning about plagiarism is that students may mistakenly believe that they know all there is to know about citing information properly (Schuetze, 2004).
C. With increased confidence, students develop an inaccurate perception that they are fully knowledgeable about their ability to avoid plagiarism and this would hypothetically result in not understanding the complexities involved in proper citations in scientific papers (Schuetze, 2004).
D. According to Schuetze (2004, p. 259), "One danger of increasing students' confidence in their ability to avoid plagiarism is that this overconfidence could leave them unaware that they do not understand the complexities of proper citation."

Question #: 7

What is the change in heat when 0.327 g of carbon reacts with oxygen to form carbon dioxide? \( \Delta H_f^\circ \) for \( \text{CO}_2 \) is \(-393.5 \text{ kJ/mol}\).

Report your answer with three significant figures. Do NOT include units in your answer.
Question #: 8

A sample of lead takes $93.4 \text{ J}$ of energy to heat from $22.3 \degree \text{C}$ to $40.4 \degree \text{C}$. What is the mass of the lead? The specific heat of lead is $0.129 \text{ J/(g•K)}$.

Report your answer to \textbf{one decimal place}. Do \textbf{NOT} include units in your answer.

\[ \text{1. } 40.0 \text{ g lead} \]

Question #: 9

Consider the reactions
\[ \text{H}_2\text{O}(g) + \text{CH}_4(g) \rightarrow \text{CO}(g) + 3 \text{H}_2(g) \quad H = 206 \text{ kJ} \]
\[ \text{CO}(g) + \text{H}_2\text{O}(g) \rightarrow \text{CO}_2(g) + \text{H}_2(g) \quad H = -41 \text{ kJ} \]

The $\Delta H$ for the overall reaction shown below is \[ \text{1. } 165 \text{ kJ/mol} \].

Report your answer to \textbf{THREE} significant figures. Do \textbf{NOT} include units in your answer. \textbf{Only exact number will be accepted as correct}.

\[ 2 \text{H}_2\text{O}(g) + \text{CH}_4(g) \rightarrow \text{CO}_2(g) + 4 \text{H}_2(g) \]

\[ \text{1. } 165 \]

Question #: 10

What is the predicted van't Hoff factor for the substances below? Report your answer as a \textbf{whole} number. Do \textbf{NOT} include units in your answer.

\[ \text{1. } 3 \]

\[ \text{Ba(OH)}_2 \]
\[ \text{C}_6\text{H}_{12}\text{O}_6 \]
\[ \text{K}_3\text{PO}_4 \]
\[ \text{HNO}_3 \]
A solution was prepared by adding 10.32 grams of sucrose ($C_{12}H_{22}O_{11}$, m.w. = 342.34 g/mol) to 170 mL of ethanol ($C_2H_6O$). What is the freezing point of this solution? The normal freezing point of ethanol is $-114.1 \, ^\circ C$ and its freezing point depression constant is $1.99 \, ^\circ C/m$. The density of ethanol is 0.789 g/mL.

A. $-114.1 \, ^\circ C$
B. $-114.5 \, ^\circ C$
C. $-115.4 \, ^\circ C$
D. $0 \, ^\circ C$

A student prepared a sugar solution containing 1.062 g sugar ($C_{12}H_{22}O_{11}$) in 24.85 mL of water and collected the following freezing point data. What is $K_f$ of water based on the student’s data?
A particular first-order reaction has a rate constant $1.35 \times 10^2 \text{ s}^{-1}$ at $25^\circ\text{C}$. What is the magnitude of $k$ at $75^\circ\text{C}$ if the activation energy is $85.6 \text{ kJ/mol}$?

- A. 670
- B. $3.47 \times 10^4$
- C. $3.85 \times 10^6$
- ✓D. $1.93 \times 10^4$

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 $22.00^\circ\text{C}$. Based upon the student's data, what is the rate of reaction of O$_2$(g)?
A student collected the following data for the reaction shown below. What is the rate constant, k, for the reaction?

\[ 2A + B \rightarrow C + D \]

<table>
<thead>
<tr>
<th>Experiment</th>
<th>[A]</th>
<th>[B]</th>
<th>initial rate (M/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.125</td>
<td>0.150</td>
<td>(1.04 \times 10^{-2})</td>
</tr>
<tr>
<td>2</td>
<td>0.250</td>
<td>0.150</td>
<td>(4.18 \times 10^{-2})</td>
</tr>
</tbody>
</table>

**Question #**: 15

A student collected the following data for the reaction shown below. What is the rate constant, k, for the reaction?
A. 0.0048 \text{ M}^{-1} \text{s}^{-1}
✓B. 0.666 \text{ M}^{-1} \text{s}^{-1}
C. 0.0348 \text{ M}^{-1} \text{s}^{-1}
D. 0.329 \text{ M}^{-1} \text{s}^{-1}

Question #: 16

For the reaction

\[
\text{CoO(s)} + \text{H}_2(\text{g}) \rightleftharpoons \text{Co(s)} + \text{H}_2\text{O(g)}
\]

at 550°C, \( K = 67 \). What is the equilibrium constant expression?

A. \[
\frac{[\text{CoO}][\text{H}_2]}{[\text{Co}][\text{H}_2\text{O}]}\]
B. \[
\frac{[\text{Co}][\text{H}_2\text{O}]}{[\text{CoO}][\text{H}_2]}\]
C. \[
\frac{[\text{Co}][\text{H}_2\text{O}]}{[\text{H}_2]}\]
✓D. \[
\frac{[\text{H}_2\text{O}]}{[\text{H}_2]}\]
**Question #: 17**

Consider the following chemical reaction:

\[ C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g) \]

The contents of a 1.00 L container at equilibrium were analyzed and found to contain 0.20 mol C, 0.20 mol H₂O, 0.60 mol CO, and 0.60 mol H₂. What is the value of the equilibrium constant, \( K_{eq} \), for this reaction?

A. 0.11  
B. 0.56  
>C. 1.8  
D. 0.0

**Question #: 18**

Consider the equilibrium for the following reaction:

\[ Fe^{3+}(aq) + SCN^-(aq) \rightarrow FeSCN^{2+}(aq) \]

The absorbance of a standard 0.000200 M FeSCN\(^{2+}\) solution was determined to be 0.759. The absorbance of an unknown concentration FeSCN\(^{2+}\) solution was found to be 0.323 at equilibrium. What is the [FeSCN\(^{2+}\)]\(_{eq}\)?

A. \(4.70 \times 10^{-4}\) M  
B. \(1.23 \times 10^{-3}\) M  
>C. \(8.51 \times 10^{-5}\) M  
D. \(2.00 \times 10^{-4}\) M

**Question #: 19**

In lab, you studied the following reaction:

\[ Fe^{3+}(aq) + SCN^-(aq) \rightleftharpoons FeSCN^{2+}(aq) \]

(Light Yellow) \hspace{1cm} (Deep Red)

What happened when additional KSCN was added?

A. The color in the test tube became a deeper red because the equilibrium shifted to make more reactants.
B. The color in the test tube became a deeper red because the equilibrium shifted to make more products.
C. The color in the test tube became a lighter yellow because the equilibrium shifted to make more reactants.
D. The color in the test tube became a lighter yellow because the equilibrium shifted to make more products.

Question #: 20

Nitrosyl bromide decomposes according to the following equation.

$$2 \text{NOBr(g)} \rightleftharpoons 2 \text{NO(g)} + \text{Br}_2(g)$$

A 0.39 mol sample of NOBr was placed in an empty 1.00 L flask. At equilibrium, the flask contained 0.31 mol of NOBr. How many moles of NO and Br$_2$ are in the flask at equilibrium?

A. 0.31 moles NO and 0.08 moles Br$_2$
B. 0.18 moles NO and 0.090 moles Br$_2$
C. 0.08 moles NO and 0.04 moles Br$_2$
D. 0.36 moles NO and 0.23 moles Br$_2$

Question #: 21

Solid HgO, liquid Hg, and gaseous O$_2$ are placed in a glass bulb and allowed to reach equilibrium at a given temperature. Which action will increase the mass of HgO in the bulb?

$$2\text{HgO(s)} \rightleftharpoons 2\text{Hg(l)} + \text{O}_2(g) \quad \Delta H = +43.4 \text{ kcal}$$

A. removing some O$_2$
B. reducing the volume of the bulb
C. increasing the temperature
D. removing some Hg

Question #: 22

Which test measures the amount of growth limiting substance in the water?
A. turbidity
B. water hardness
C. total dissolved solids✓
D. phosphate

Question #: 23

A standard curve was produced using varying concentrations of KCl and the results are shown below. A sample of pond water was found to have a conductivity of 535 μS/cm. What is the concentration of total dissolved solids in the water sample? Recall the TDS constant is 0.67.

A. 392 mg/L
B. 478 mg/L✓
C. 798 mg/L
D. 247 mg/L

Question #: 24

In order to produce a standard curve, you need to dilute a 0.1 M stock solution to produce 100.0 mL of a $5 \times 10^{-4}$ M solution. If you have only a 10 mL graduated cylinder and a 100mL volumetric flask and some beakers, what is the best way to perform this dilution?

A.
• Put 0.0002 mL in the 100 mL volumetric flask and dilute to the line.
  B.
• Put 10.00 mL of stock solution in the 100 mL flask and dilute to the line.
• Pour this solution into a beaker.
• Take 3 mL of the resulting solution, add it to the clean volumetric flask, and dilute to the line.
  C.
• Put 0.05 mL of stock solution in the 100 mL flask and dilute to the line.
  ✓
• Put 5.00 mL of stock solution in the 100 mL flask and dilute to the line.
• Pour this solution into a beaker.
• Take 10.00 mL of the resulting solution, add it to the clean volumetric flask, and dilute to the line.

Question #: 25

According to the U.S. Geological Survey, soft water has 0 to ____ milligrams per liter of CaCO₃.

✓ A. 60
  B. 180
  C. 121
  D. 207

Question #: 26

Consider a solution that contains 0.50 moles of NaCH₃CH₂COO and 0.50 moles of CH₃CH₂COOH in 1.0 L of water.
If 0.10 mol of NaOH is added to this buffer solution, the pH of the solution will _____ [increase, decrease]. The pH does not change more drastically because the NaOH reacts with the _____ [NaCH₃CH₂COO, CH₃CH₂COOH] present in the buffer solution.

1. increase
  2. CH₃CH₂COOH

Question #: 27

A solution prepared by mixing formic acid with sodium formate was titrated with sodium hydroxide and produced the following titration curve. At what volume of base was the buffer capacity of the solution exceeded?
A. 8.5 mL  
B. 6.0 mL  
C. 4.2 mL  
D. 3.5 mL

**Question #**: 28

What is the pH of a mixture of 0.475 M benzoic acid and 0.348 M sodium benzoate? The $K_a$ of benzoic acid is $6.5 \times 10^{-5}$.

Report your answer to **two decimal places**. Do **NOT** include units in your answer.

1. 4.05

**Question #**: 29

Which substance can be added to a solution of sodium propionate to produce a buffer?

A. sodium chloride  
B. phosphoric acid  
C. acetic acid
D. propionic acid

Question #: 30

A buffer of pH 2.54 is to be prepared from a weak acid and its salt. Which acid would be best to prepare a buffer with this pH?

✓ A. phthalic acid, $K_1 = 1.12 \times 10^{-3}$ (first ionization)
   B. malic acid, $K_2 = 8.00 \times 10^{-6}$ (second ionization)
   C. tartaric acid, $K = 4.31 \times 10^{-5}$ (second ionization)
   D. citric acid, $K = 7.45 \times 10^{-4}$ (first ionization)

Question #: 31

What is the molar solubility of BaF$_2$? The solubility product constant, $K_{sp}$, of BaF$_2$ in water is $1.84 \times 10^{-7}$.

✓ A. $3.58 \times 10^{-3}$ M
   B. $1.66 \times 10^{-8}$ M
   C. $4.6 \times 10^{-8}$ M
   D. $7.3 \times 10^{-7}$ M

Question #: 32

The solubility of cobalt(III) hydroxide (m.w. = 109.96 g/mol) is $5.4 \times 10^{-8}$ mg/100 mL of water at 25 °C. What is the $K_{sp}$ for cobalt(III) hydroxide?

A. $5.8 \times 10^{-50}$
   B. $5.8 \times 10^{-46}$
   C. $1.7 \times 10^{-45}$
   ✓ D. $1.6 \times 10^{-44}$

Question #: 33
Excess solid Ca(OH)$_2$ was added to a solution and allowed to stand for several days. The solution was filtered to remove excess solid Ca(OH)$_2$. 25.00 mL of the resulting Ca(OH)$_2$ solution was then titrated with 19.35 mL of a standardized 0.137 M HCl solution. What is the $K_{sp}$ of Ca(OH)$_2$?

A. $1.29 \times 10^{-3}$  
B. $2.65 \times 10^{-3}$  
C. $5.62 \times 10^{-3}$  
✓D. $5.96 \times 10^{-4}$

**Question #: 34**

Zinc powder in an acidic solution is used as a primary standard for standardizing EDTA solutions. Why do you standardize a solution before using it in a titration?

A. To remove the water from hydrochloric acid.  
B. You cannot titrate an acid with another acid.  
C. Because the volume of the solution was not properly recorded.  
✓D. To accurately determine the concentration of the solution.

**Question #: 35**

Which one is the correct solubility product expression for the following reaction?  
\[ \text{PbSO}_4(s) \Leftrightarrow \text{Pb}^{2+}(aq) + \text{SO}_4^{2-}(aq) \]

A. \[
\frac{[\text{Pb}^{2+}][\text{SO}_4^{2-}]}{[\text{PbSO}_4]} \]

B. \[
\frac{[\text{PbSO}_4]}{[\text{Pb}^{2+}][\text{SO}_4^{2-}]} \]

✓C. \[
[\text{Pb}^{+2}][\text{SO}_4^{-2}] \]

D. \[
[\text{PbSO}_4] \]
**Question #: 36**

Complete and balance the following chemical reaction.

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Coefficient</th>
<th>Coefficient</th>
<th>Substance</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (\text{H}_4\text{PO}_4)</td>
<td>2 (\text{Pb(NO}_3\text{)}_4)</td>
<td>3</td>
<td>4</td>
<td>5 (\text{NH}_4\text{NO}_3)</td>
</tr>
</tbody>
</table>

For any coefficient of "1" enter the value of 1 in the blank. Enter ionic charges without superscripts; e.g., \(\text{Ca}^2+\). All parentheses must be used correctly in chemical formulas. Do **NOT** include the states of matter in your answer.

1. 4
2. 3
3. 1
4. \(\text{Pb}_3(\text{PO}_4)_4\)
5. 12

*Attachment:*

![attachment_for_itemid_15713.JPG](attachment_for_itemid_15713.JPG)

**Question #: 37**

What result would you expect from a pH paper test of a solution of \(\text{H}_3\text{BO}_3\)?

A. pH paper will turn blue

✓ B. pH paper will turn red

C. pH paper will turn green

D. There will be no change in the color of the pH paper.

**Question #: 38**

Various qualitative tests were performed on an unknown sample and the following results were obtained:
1. The unknown was soluble in water.
2. Its aqueous solutions had a pH ranging from 8 to 10.
3. It bubbled in vinegar.
A solution containing a mixture of metal cations was treated as outlined and the following observations were collected.

- **Step 1**: Dilute HCl was added and a precipitate formed. The precipitate was filtered off.
- **Step 2**: H₂S was bubbled through the acidic solution. No precipitate formed.
- **Step 3**: The pH was raised to about 9 and H₂S was again bubbled through the solution. A precipitate formed and filtered off.
- **Step 4**: Sodium carbonate was added to the filtered solution. A precipitate formed and was filtered off.

What can be said about the presence of each of these groups of cations in the original solution? Fill in each blank with the letter corresponding to your choice.

A. None of these ions were present
B. Unknown
C. All of these ions were present
D. At least one of these ions was present.

<table>
<thead>
<tr>
<th>Cation Group</th>
<th>Description</th>
<th>Present in original solution?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag⁺, Pb²⁺, Hg₂²⁺</td>
<td>form insoluble chlorides</td>
<td>1</td>
</tr>
<tr>
<td>Bi³⁺, Cd²⁺, Cu²⁺, Hg²⁺, Pb²⁺, Sb³⁺</td>
<td>form acid-insoluble sulfides</td>
<td>2</td>
</tr>
<tr>
<td>Al³⁺, Co²⁺, Cr³⁺, Fe²⁺, Mn²⁺</td>
<td>form base-insoluble sulfides or hydroxides</td>
<td>3</td>
</tr>
<tr>
<td>Ba²⁺, Ca²⁺, Mg²⁺, Sr²⁺</td>
<td>form insoluble carbonates</td>
<td>4</td>
</tr>
<tr>
<td>Li⁺, Na⁺, K⁺, NH₄⁺</td>
<td>completely soluble</td>
<td>5</td>
</tr>
</tbody>
</table>

1. D[d]
2. A[a]
3. D[d]
Question #: 40

Which substance turns a deep blue when it reacts with iodine?

A. calcium sulfate
✓B. cornstarch
C. potassium bitartrate
D. calcium carbonate