Please put each of your answers on the front cover to make it easier for grading. I will also check in the test booklet for problems that require calculations. If the answer is wrong, partial credit will be given whenever possible. All questions are worth the same amount.

You must have calculations present within the test to get credit for an answer even if the answer is correct.

<table>
<thead>
<tr>
<th></th>
<th>a. substance</th>
<th>Group of identical molecules</th>
<th>Boiling point gas at room temperature, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2700 kg/m³</td>
<td>2.70 \times 10^3 \text{ kg/m}³</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>A material that does not break up into ions.</td>
<td>sugar</td>
<td>a. the light bulb would not light at all</td>
</tr>
<tr>
<td>4</td>
<td>Potassium sulfate</td>
<td>+1</td>
<td>Sulfate ion \text{ SO}_4^{2-}</td>
</tr>
<tr>
<td>5</td>
<td>2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2</td>
<td>78.3g</td>
<td>89.8%</td>
</tr>
<tr>
<td>6</td>
<td>2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 (aq) + 2\text{H}_2\text{O}</td>
<td>0.0522M</td>
<td>5.228 \times 10^{-3} \text{ moles}</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>8</td>
<td>3.37 \times 10^{26} \text{ atoms}</td>
<td>28.0g</td>
<td>46.7%</td>
</tr>
</tbody>
</table>
### Constants
- \( \text{mol} \) = \( 6.02 \times 10^{23} \) /mol
- \( T \text{(K)} = t \text{(0ºC)} + 273.15 \)
- \( \text{d} = \frac{m}{V} \)
- \( RT = \frac{2}{3} N \mu \)
- \( \text{g} = 9.807 \text{ m/s}^2 \)
- \( \text{R} = 0.0821 \text{ L atm / mol K} \)
- \( \text{R} = 8.3145 \text{ J/(mol K)} \)
- \( m_u / e = -5.686 \times 10^{-12} \text{ kg/C} \)
- \( e = -1.602 \times 10^{-19} \text{ C} \)
- \( \text{c} = 3.0 \times 10^8 \text{ m/s} \)
- \( \text{h} = 6.626 \times 10^{-34} \text{ J s} \)
- \( B = 2.179 \times 10^{-18} \text{ J} \)

### Conversions
- \( 1 \text{ atm} = 760 \text{ mmHg} \)
- \( 1 \text{ N} = 1 \text{ kg m/s}^2 \)
- \( d = \frac{m}{V} \)
- \( PV = nRT \)
- \( P = \frac{\text{g x d x h}}{\text{d x h}} \)
- \( \text{rms} \)
- \( \text{u} = \frac{3RT}{M} \)
- \( \text{g} = 9.807 \text{ m/s}^2 \)
- \( \text{kg} / \text{ms}^2 \)
- \( \text{d} \text{Hg} \times \text{h} \text{Hg} = \text{d} \text{l} \times \text{h} \text{l} \)
- \( \Delta H = q + w \)
- \( m \text{e} / e = -5.686 \times 10^{-12} \text{ kg} \cdot \text{e} \)
- \( 1 \text{ atm} = 760 \text{ mmHg} \)

### Equations
- \( n = 6.02 \times 10^{23} / \text{mol} \)
- \( T = 0.9 \text{(0ºC)} + 273.15 \)
- \( \text{d} = \frac{m}{V} \)
- \( PV = nRT \)
- \( \Delta H = q + w \)
- \( \text{E} = \frac{3RT}{M} \)
- \( \mu = \frac{2}{3} N \)
- \( \text{w} = -P \Delta V \)
- \( \Delta H_{\text{rxn}} = \Delta H_1 + \Delta H_2 + \Delta H_3 + ... \)
- \( \text{E}_{\text{phot}} = \text{hv} \)

### The Periodic Table of the Elements

<table>
<thead>
<tr>
<th>IA</th>
<th>II A</th>
<th>II B</th>
<th>VB</th>
<th>VIB</th>
<th>VII B</th>
<th>VIII B</th>
<th>IB</th>
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<td>P</td>
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</table>
1. a. Carbon dioxide is an example of a:
   a. substance
   b. element
   c. heterogeneous mixture
   d. homogeneous mixture
   b. Define your answer in 5 words or less.
   c. Name a physical property that could be used to identify carbon dioxide.

2. Aluminum is a lightweight metal (density = 2.70 g/cm³) used in aircraft construction, high-voltage transmission lines, beverage cans, and foils.
   a. What is its density in kilograms per cubic meter?
   b. Express your answer in scientific notation with the correct units from part a
   c. How many significant figures should be present in your answer?

3. a. Define the term "nonelectrolyte" in 10 words or less.
   b. Give an example of a nonelectrolyte.
   c. If a highly concentrated nonelectrolyte were dissolved in water and a voltage applied: which of the following would be the most likely
      a. A light bulb would not light at all.
      b. A light bulb would give a dim light.
      c. The light bulb would light up brightly.

4. a. Name the following compound: \( \text{K}_2\text{SO}_4 \)
   b. What is the charge on the cation?
   c. What is the name and formula of the acid associated with the anion?
5. When baking soda (sodium bicarbonate or sodium hydrogen carbonate, NaHCO₃) is heated, it releases carbon dioxide gas, which is responsible for the rising of cookies, donuts, and bread. The equation for this process is:

\[ \text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2. \]

a. What is the balanced chemical equation for this reaction?
b. Calculate the mass of NaHCO₃ required to produce 20.5 g of CO₂.
c. What is the percent yield if you only produce 18.4 g of CO₂ from the mass of NaHCO₃ calculated in question b?

6. 34.62 mL of 0.1510 M NaOH was needed to neutralize 50.0 mL of an H₂SO₄ solution.
   a. What is the balanced chemical equation for this reaction?
   b. What is the concentration of the original sulfuric acid solution?
   c. How many moles of NaOH are used?

7. Consider a neutral atom of the element phosphorus. \(^{31}_{15}\text{P}\)
   a. How many electrons does the atom contain?
   b. How many protons does the atom contain?
   c. How many neutrons does the atom contain?

8. Urea [(NH₂)₂CO] is used for fertilizer and many other things.
   a. Calculate the number of N atoms in \(1.68 \times 10^4\) g of urea.
   b. What is the mass of N in 1 mole of urea?
   c. What is the mass percent N in urea?