1. Which of the following isotopes listed below is made up of 14 protons, 15 neutrons, and 14 electrons?
   a. $^{15}$Si
   b. $^{29}$Si
   c. $^{14}$Si
   d. $^{31}$P
   e. $^{14}$P
2. Write 7,040,010,000,000,000 in scientific notation.
   a. 7.04001 x 10^{15}
   b. 7.04 x 10^{15}
   c. 704 x 10^{12}
   d. 7040001 x 10^{10}
   e. 7 x 10^{15}
3. Which of the following values has the greatest number of significant figures?
   a. 0.0015
   b. 0.1500
   c. 0.1500
   d. 1.50
   e. 0.0150
4. A 100-g piece of metal is heated to 150°C and dropped into 90 g of water at 45°C. If the final temperature of the water is 60°C, what is the specific heat of the metal in J/g°C?
   a. 0.5273
   b. 1.2321
   c. 0.7263
   d. 0.8231
   e. 0.6276
5. An object was placed in a graduated cylinder filled with water. This caused the water level to rise to 6.12 ml from 1.2 ml. If the object has a mass of 0.05 lbs what is the density in g/cm³?
   a. 1.16
   b. 2.35
   c. 4.61
   d. 0.98
   e. 1.87
6. The average atomic mass of strontium is calculated from two isotopes. $^{85}\text{Sr}$ has a mass of 84.91 and $^{90}\text{Sr}$ has a mass of 89.93. Use the atomic mass of strontium to calculate the abundance of $^{90}\text{Sr}$.

   a. 0.54  
   b. 0.51  
   c. 0.50  
   d. 0.46  
   e. 0.41
7. How much energy in kJ can you acquire by burning 5g of protein, 15g of fat and 30 g of carbohydrates?
   a. 500
   b. 120
   c. 723
   d. 1165
   e. 392
8. A sample of an unknown metal has a mass of 120.7g. As the sample cools from 90.5°C to 25.7°C, it releases 7020J of energy. What is the specific heat of the sample? (in J/g°C)
   a. -0.8975
   b. 0.8975
   c. 1.114
   d. -1.114
9. Which element is in period 3 and group 2
   a. Na
   b. K
   c. Be
   d. Li
   e. Mg
10. When 1.0 g of gasoline burns, 11,500 cal of energy are given off. If the density of gasoline is 0.74 g/mL, how many kilocalories of energy are obtained from 1.5 gal of gasoline?

   a. \(3.5 \times 10^5\)
   b. \(2.4 \times 10^6\)
   c. \(2.4 \times 10^4\)
   d. \(4.8 \times 10^6\)
   e. \(4.8 \times 10^4\)
11. A bottle of mouthwash is 35% alcohol by mass. Assuming you obtained 150g of alcohol how many liters of mouthwash did you require? (density of mouthwash is 0.876 g/mL)
   a. 0.124 L  
   b. 0.489 L  
   c. 0.165 L  
   d. 0.726 L  
   e. 0.273 L
12. Convert 8.5 miles per hour (mi/h) into meters per second (m/s).
   a. 3.80
   b. 1.68
   c. 2.56
   d. 2.90
   e. 4.11
13. Convert -315.3 Fahrenheit to K.
   a. 100
   b. 80.2
   c. 34.8
   d. 112.4
   e. 201.5
14. Using your formula sheet what would be the correct conversion factor for centimeters in a mile in scientific notation?
   a. $1.80 \times 10^3$ cm/mile
   b. $1.27 \times 10^5$ cm/mile
   c. $1.42 \times 10^3$ cm/mile
   d. $1.61 \times 10^5$ cm/mile
   e. $1.11 \times 10^4$ cm/mile
15. Which of the following statements is true?
   a. Protons have a neutral charge.
   b. The atomic mass of an element is the number of electrons and protons.
   c. The last group of the periodic table houses the noble gases.
   d. Kryptonite is an element.
   e. Fahrenheit is an official SI unit.
16. Which of the following represents a chemical change?
   a. You leave your bicycle outside and rust develops on the frame.
   b. Short hair grows until it is long.
   c. Water is boiled to cook pasta.
   d. Carrots are grated into a salad.
   e. Rip a sheet of paper in half then crumple the two pieces.
17. What is the density of gold assuming when you added a 100 g piece of gold to your graduated cylinder, the water level rises from 10 mL to 15.18 mL?
   a. 11.4 g/cm$^3$
   b. 19.3 g/cm$^3$
   c. 17.8 g/cm$^3$
   d. 11.8 g/cm$^3$
   e. 16.3 g/cm$^3$
18. Which of the following elements are incorrectly matched to their chemical symbol?
   a. Na - Sodium
   b. Pb - Lead
   c. Fe - Iron
   d. B - Bromine
   e. Au - Gold
### Length

<table>
<thead>
<tr>
<th>Unit</th>
<th>SI Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>meter (m)</td>
<td>1 m = 1.0936 yd</td>
<td></td>
</tr>
<tr>
<td>centimeter</td>
<td>1 cm = 0.39370 in</td>
<td></td>
</tr>
<tr>
<td>inch (in)</td>
<td>2.54 cm (exactly)</td>
<td></td>
</tr>
<tr>
<td>kilometer</td>
<td>0.62137 mi</td>
<td></td>
</tr>
<tr>
<td>mile (mi)</td>
<td>5280 ft</td>
<td></td>
</tr>
<tr>
<td>Ångstrom</td>
<td>1 Å = 10⁻¹⁰ m</td>
<td></td>
</tr>
</tbody>
</table>

### Temperature

<table>
<thead>
<tr>
<th>Unit</th>
<th>SI Unit</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelvin (K)</td>
<td>0 K = -273.15 °C</td>
<td>-154.01 °F</td>
</tr>
<tr>
<td>°C</td>
<td>°C = °F - 32</td>
<td>°F = 1.8(°C) + 32</td>
</tr>
</tbody>
</table>

### Energy (derived)

<table>
<thead>
<tr>
<th>Unit</th>
<th>SI Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>joule (J)</td>
<td>1 J = 1 kg⋅m²/s²</td>
<td></td>
</tr>
<tr>
<td>calorie (cal)</td>
<td>1 Cal = 1.8</td>
<td></td>
</tr>
<tr>
<td>electronvolt (eV)</td>
<td>1 eV = 1.6022 × 10⁻¹⁹ J</td>
<td></td>
</tr>
</tbody>
</table>

### Pressure (derived)

<table>
<thead>
<tr>
<th>Unit</th>
<th>SI Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>pascal (Pa)</td>
<td>1 Pa = 1 N/m²</td>
<td></td>
</tr>
<tr>
<td>torr</td>
<td>1 torr = 1 mmHg</td>
<td></td>
</tr>
</tbody>
</table>

### Volume (derived)

<table>
<thead>
<tr>
<th>Unit</th>
<th>SI Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>liter (L)</td>
<td>1 L = 10⁻³ m³</td>
<td></td>
</tr>
<tr>
<td>liter</td>
<td>= 1 dm³</td>
<td></td>
</tr>
<tr>
<td>cm³</td>
<td>= 10⁻³ cm³</td>
<td></td>
</tr>
<tr>
<td>quarts (qt)</td>
<td>1.0567 qt</td>
<td></td>
</tr>
<tr>
<td>gallons (gal)</td>
<td>4 qt = 3.7854 L</td>
<td></td>
</tr>
</tbody>
</table>

### Mass

<table>
<thead>
<tr>
<th>Unit</th>
<th>SI Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilogram (kg)</td>
<td>1 kg = 2.2046 lb</td>
<td></td>
</tr>
<tr>
<td>pound (lb)</td>
<td>453.59 g</td>
<td></td>
</tr>
<tr>
<td>ounce (oz)</td>
<td>16 oz</td>
<td></td>
</tr>
<tr>
<td>atomic mass unit (amu)</td>
<td>1 amu = 1.66053873 × 10⁻²⁷ kg</td>
<td></td>
</tr>
<tr>
<td>metric ton</td>
<td>1000 kg</td>
<td></td>
</tr>
</tbody>
</table>

### Geometric Relationships

- Circumference of a circle \( C = 2\pi r \)
- Area of a circle \( A = \pi r² \)
- Surface area of a sphere \( A = 4\pi r² \)
- Volume of a sphere \( V = \frac{4}{3}\pi r³ \)
- Volume of a cylinder \( V = \pi r² h \)

### Fundamental Constants

<table>
<thead>
<tr>
<th>Atomic mass unit</th>
<th>1 amu</th>
<th>1 g</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>= 1.66053873 × 10⁻²⁷ kg</td>
<td>= 6.02214199 × 10⁻¹⁹ amu</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Avogadro's number</th>
<th>( N_A )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>= 6.02214179 × 10⁻¹⁹ mol</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mass of an electron</th>
<th>( m_e )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>= 5.48579999 × 10⁻³ amu</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mass of a neutron</th>
<th>( m_n )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>= 1.00866492 amu</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mass of a proton</th>
<th>( m_p )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>= 1.00727647 amu</td>
</tr>
</tbody>
</table>

### Prefixes

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Scientific Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>peta</td>
<td>P</td>
<td>( 10^{15} )</td>
</tr>
<tr>
<td>tera</td>
<td>T</td>
<td>( 10^{12} )</td>
</tr>
<tr>
<td>giga</td>
<td>G</td>
<td>( 10^9 )</td>
</tr>
<tr>
<td>mega</td>
<td>M</td>
<td>( 10^6 )</td>
</tr>
<tr>
<td>kilo</td>
<td>k</td>
<td>( 10^3 )</td>
</tr>
<tr>
<td>centi</td>
<td>c</td>
<td>( 10^{-2} )</td>
</tr>
<tr>
<td>milli</td>
<td>m</td>
<td>( 10^{-3} )</td>
</tr>
<tr>
<td>micro</td>
<td>( \mu )</td>
<td>( 10^{-6} )</td>
</tr>
<tr>
<td>nano</td>
<td>n</td>
<td>( 10^{-9} )</td>
</tr>
<tr>
<td>pico</td>
<td>p</td>
<td>( 10^{-12} )</td>
</tr>
<tr>
<td>femto</td>
<td>f</td>
<td>( 10^{-15} )</td>
</tr>
</tbody>
</table>
### TABLE 3.9 Energy Values for the Three Food Types

<table>
<thead>
<tr>
<th>Food Type</th>
<th>kJ/g</th>
<th>kcal/g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>17</td>
<td>4</td>
</tr>
<tr>
<td>Fat</td>
<td>38</td>
<td>9</td>
</tr>
<tr>
<td>Protein</td>
<td>17</td>
<td>4</td>
</tr>
</tbody>
</table>

### TABLE 3.8 Specific Heats of Some Substances

<table>
<thead>
<tr>
<th>Substance</th>
<th>Specific Heat (J/g °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elements</strong></td>
<td></td>
</tr>
<tr>
<td>Aluminum, Al(s)</td>
<td>0.897</td>
</tr>
<tr>
<td>Copper, Cu(s)</td>
<td>0.385</td>
</tr>
<tr>
<td>Gold, Au(s)</td>
<td>0.129</td>
</tr>
<tr>
<td>Iron, Fe(s)</td>
<td>0.452</td>
</tr>
<tr>
<td>Silver, Ag(s)</td>
<td>0.235</td>
</tr>
<tr>
<td>Titanium, Ti(s)</td>
<td>0.523</td>
</tr>
<tr>
<td><strong>Compounds</strong></td>
<td></td>
</tr>
<tr>
<td>Ammonia, NH₃(g)</td>
<td>2.04</td>
</tr>
<tr>
<td>Ethanol, C₂H₅OH(l)</td>
<td>2.46</td>
</tr>
<tr>
<td>Sodium chloride, NaCl(s)</td>
<td>0.864</td>
</tr>
<tr>
<td>Water, H₂O(l)</td>
<td>4.184</td>
</tr>
<tr>
<td>Water, H₂O(s)</td>
<td>2.03</td>
</tr>
</tbody>
</table>