1. What is the density of water?
1.00 g/mL

2. Figure out the density of the following samples:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Mass</th>
<th>Volume</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>13.4 g</td>
<td>11.23 mL</td>
<td>1.19 g/mL</td>
</tr>
<tr>
<td>B</td>
<td>234.5 g</td>
<td>222.2 mL</td>
<td>1.055 g/mL</td>
</tr>
<tr>
<td>* C</td>
<td>1.9 g</td>
<td>2.55 mL</td>
<td>0.75 g/mL</td>
</tr>
<tr>
<td>* D</td>
<td>50.3 g</td>
<td>62.5 mL</td>
<td>0.805 g/mL</td>
</tr>
</tbody>
</table>

3. Put an asterisk (*) next to the samples above that would float on water.

4. A jeweler suspects that a piece of jewelry in his collection is fake. He knows that the density of gold is 19.3 g/cm$^3$. If the volume if the piece of jewelry is 6 cm$^3$, and its mass is 109 grams, is the piece fake? Why or why not?

\[
D = \frac{m}{V} \\
= \frac{109 \text{ g}}{6 \text{ cm}^3} \\
= 20 \text{ g/cm}^3
\]

It is fake. If it was real gold, the densities would be the same because density is an intensive property.

5. Substances A and B have the same volume but the mass of B is twice as great as the mass of A. How do the densities of the two substances compare?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>B is twice as dense as A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>2 mL</td>
<td>2 mL</td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>1 g</td>
<td>2 g</td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>0.5 g/mL</td>
<td>1 g/mL</td>
<td></td>
</tr>
</tbody>
</table>
6. The mass of a cube of copper is 243 grams. What is the mass of a cube of gold that has the same dimensions? (Density of Cu = 8.92 g/cm\(^3\);
density of gold = 19.30 g/cm\(^3\))

\[
\begin{array}{l|l}
\text{Copper} & \text{Gold} \\
\hline
V = \frac{m}{D} & m = DV \\
= \frac{243 \text{ g}}{8.92 \text{ g/cm}^3} & = (19.30 \text{ g/cm}^3)(27.2 \text{ cm}^3) \\
= 27.2 \text{ cm}^3 & = 525 \text{ g}
\end{array}
\]

7. A block of wood having the dimensions of 345 cm X 0.066 m X 78 mm weighs 3.44 kg. What is the density of the wood expressed in grams per cubic centimeter?

\[
D = \frac{m}{V} \\
= \frac{3.44 \text{ kg}}{(345 \text{ cm} \times 0.066 \text{ m} \times 78 \text{ mm})} \\
= \frac{3440 \text{ g}}{(345 \text{ cm} \times 6.6 \text{ cm} \times 7.8 \text{ cm})} \\
= 0.19 \text{ g/cm}^3
\]

8. Chunks of lead weighing 2.4948 hectograms were dropped into a graduated cylinder containing 40 mL of water. The water rose to a level of 62 mL. What is the density of lead?

\[
D = \frac{m}{V} \\
= \frac{2.4948 \text{ hg}}{(62 \text{ mL} - 40 \text{ mL})} \\
= \frac{249.48 \text{ g}}{22 \text{ mL}} \\
= 11 \text{ g/mL}
\]

9. A gold nugget was found with a volume of 56.4 cm\(^3\). How much would this nugget be worth at current values? ($370.00/troy ounce) (1 troy oz. = 31 grams) (density Au = 19.30 g/cm\(^3\))

\[
m = DV \\
= (19.30 \text{ g/cm}^3)(56.4 \text{ cm}^3) \\
= 1090 \text{ g} \\
\text{1090g/31g} = 35 \text{ troy oz.} \\
(35 \text{ troy oz})(370.00) = 12,950.00 \text{ dollars}
\]

10. Look at the chart containing element densities in appendix A. If you had an unknown metal with a mass of 15.113 grams, and a volume of 5.6 cm\(^3\), what would that metal be?

\[
D = \frac{m}{V} \\
= \frac{15.113 \text{ g}}{5.6 \text{ cm}^3} \\
= 2.7 \text{ g/cm}^3 \quad \text{The metal is aluminum.}
\]
11. Look at the chart containing element densities in appendix A. What volume of iron would you need to have if it had a mass of 1358 grams?

\[ V = \frac{m}{\rho} \]
\[ = \frac{1358\text{g}}{7.874\ \text{g/cm}^3} \]
\[ = 172.5\ \text{cm}^3 \]

12. What happens to the density of a material if the volume is decreased?
Why? The density stays the same because decreasing the volume decreases the mass by a proportional amount. HOWEVER, if the mass were somehow held constant, then the density would increase because mass and volume are inversely proportional.

13. What happens to the density of a material if the volume is increased?
Why? The density stays the same because increasing the volume increases the mass by a proportional amount. HOWEVER, if the mass were somehow held constant, then the density would decrease because mass and volume are inversely proportional.

14. What happens to the volume of a ball of clay if your little brother squashes it flat?
The volume remains the same because there isn't a loss of clay when it is squashed, it just changes shapes.

15. What happens to the density of a ball of clay if your little brother squashes it flat?
The density of the ball of clay will remain the same. Density is an intensive property meaning that it doesn't matter how much clay there is, the density remains the same.

16. If you had a steel ball with a mass of 56 grams, and an aluminum ball with a mass of 14 grams, but they were identical in size, which one would have a greater volume, if you measured it by dropping the balls into a graduated cylinder? Both of the balls will displace the same amount of water in the graduated cylinder since they are both identical in size. This means that they are the same volume.
17. The Great Salt Lake in Utah is approximately 27 per cent salt (8 times saltier than the ocean!) Explain, in terms of density, why it is so easy to float when you're swimming in the Great Salt Lake.

Adding salt to the same volume of water adds mass. This increases the density of the water.

18. Thomas Penselneque was found to have a density of 10.5 g/mL. Would he sink or float in 376 kL of a solution that has a mass of 935 kg?

\[ D = \frac{m}{V} \]
\[ = \frac{935\text{kg}}{376\text{kL}} \]
\[ = \frac{935,000\text{g}}{376,000,000\text{mL}} \]
\[ = 0.00249\text{g/mL} \]

Thomas would sink. His density of 10.5 g/mL is greater than the density of 0.00249 g/mL possessed by the solution.

19. What is the volume of a piece of aluminum that has a mass of 2743 grams?

\[ V = \frac{m}{D} \]
\[ = \frac{2743\text{g}}{2.7\text{g/mL}} \]
\[ = 1.0 \times 10^3\text{mL} \]

20. If a sample that has a density of 3.3 g/mL is taken to the moon, how does the value of the density change?

The density doesn’t change because gravity has no effect on mass or volume. Density is an intensive property.

21. A piece of metal weighing 40.0 grams is dropped into a graduated cylinder containing 30.0 mL of water. The water rises to 44.8 mL. What is the metal?

\[ D = \frac{m}{V} \]
\[ = \frac{40.0\text{g}}{(44.8\text{mL} - 30.0\text{mL})} \]
\[ = 2.70\text{g/mL} \]

The metal is aluminum.