Appendix A

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Safety


### Appendix A

#### Storage


Hydrogen Fuel for Surface Transportation


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Vehicles


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Appendix B

Unit Conversion Factors

The following tables provide conversion factors between units in the U.S. Customary system, the metric system, and the International System (SI). To convert a quantity expressed in a unit in the left-hand column to the equivalent in a unit in the top row of a table, multiply the quantity by the factor listed as common to both units. Numbers followed by an asterisk are definitions of the relation between the two units.

### Units of Pressure

<table>
<thead>
<tr>
<th>Units</th>
<th>Pa (N • m⁻²)</th>
<th>dyn • cm⁻²</th>
<th>bar</th>
<th>atm</th>
<th>mmHg (torr)</th>
<th>in. Hg</th>
<th>lbf • in⁻²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pa (N • m⁻²)</td>
<td>= 1</td>
<td>10</td>
<td>10⁻⁵</td>
<td>9.869 x 10⁻³</td>
<td>2.953 x 10⁻⁴</td>
<td>1.450 x 10⁻⁴</td>
<td></td>
</tr>
<tr>
<td>1 dyn • cm⁻²</td>
<td>= 0.1</td>
<td>1</td>
<td>10⁻⁶</td>
<td>9.869 x 10⁻⁷</td>
<td>2.953 x 10⁻⁵</td>
<td>1.450 x 10⁻⁵</td>
<td></td>
</tr>
<tr>
<td>1 bar</td>
<td>= 10⁵*</td>
<td>10⁶</td>
<td>1</td>
<td>0.9869</td>
<td>750.0617</td>
<td>29.530</td>
<td>14.504</td>
</tr>
<tr>
<td>1 atm</td>
<td>= 101325.0*</td>
<td>1013250</td>
<td>1.013250</td>
<td>1</td>
<td>760</td>
<td>29.9213</td>
<td>14.6959</td>
</tr>
<tr>
<td>1 mmHg (torr)</td>
<td>= 133.3224</td>
<td>1333.224</td>
<td>1.333 x 10⁻³</td>
<td>1.316 x 10⁻³</td>
<td>1</td>
<td>0.0394</td>
<td>0.0193</td>
</tr>
<tr>
<td>1 in. Hg</td>
<td>= 33.86388</td>
<td>33863.88</td>
<td>0.03386388</td>
<td>0.03342105</td>
<td>25.4</td>
<td>1</td>
<td>0.4911541</td>
</tr>
<tr>
<td>1 lbf • in⁻²</td>
<td>= 6894.757</td>
<td>68947.57</td>
<td>0.06894757</td>
<td>0.06804596</td>
<td>51.71493</td>
<td>2.036021</td>
<td>1</td>
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</table>

### Units of Length

<table>
<thead>
<tr>
<th>Units</th>
<th>μm (micron)</th>
<th>cm</th>
<th>m</th>
<th>mil</th>
<th>in.</th>
<th>mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 μm (micron)</td>
<td>= 1</td>
<td>10⁴</td>
<td>10⁻⁶</td>
<td>0.03937</td>
<td>3.937 x 10⁻⁶</td>
<td>6.2137 x 10⁻¹⁰</td>
</tr>
<tr>
<td>1 cm</td>
<td>= 10⁴</td>
<td>1</td>
<td>0.01*</td>
<td>3.937 x 10⁻²</td>
<td>0.3937</td>
<td>6.2137 x 10⁻⁶</td>
</tr>
<tr>
<td>1 m</td>
<td>= 10⁶</td>
<td>100</td>
<td>1</td>
<td>3.937 x 10⁴</td>
<td>39.3701</td>
<td>6.2137 x 10⁴</td>
</tr>
<tr>
<td>1 mil</td>
<td>= 25.4</td>
<td>2.54 x 10⁻³</td>
<td>2.54 x 10⁻⁵</td>
<td>1</td>
<td>0.001</td>
<td>1.5783 x 10⁻⁸</td>
</tr>
<tr>
<td>1 in.</td>
<td>= 2.54 x 10⁴</td>
<td>2.54*</td>
<td>0.0254</td>
<td>1000</td>
<td>1</td>
<td>1.5783 x 10⁻⁵</td>
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<tr>
<td>1 mile</td>
<td>= 1.6093 x 10⁹</td>
<td>1.6093 x 10⁵</td>
<td>1.6093 x 10³</td>
<td>6.336 x 10⁷</td>
<td>6.336 x 10⁴</td>
<td>1</td>
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### Units of Area

<table>
<thead>
<tr>
<th>Units</th>
<th>μm²</th>
<th>cm²</th>
<th>m²</th>
<th>mil²</th>
<th>in.²</th>
<th>mile²</th>
</tr>
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<tbody>
<tr>
<td>1 μm²</td>
<td>= 1</td>
<td>10⁸</td>
<td>10⁻¹²</td>
<td>1.550 x 10⁻³</td>
<td>1.550 x 10⁻⁹</td>
<td>3.861 x 10⁻¹⁹</td>
</tr>
<tr>
<td>1 cm²</td>
<td>= 10⁸</td>
<td>1</td>
<td>10⁻⁴</td>
<td>1.550 x 10⁵</td>
<td>0.1550</td>
<td>3.861 x 10⁻¹¹</td>
</tr>
<tr>
<td>1 m²</td>
<td>= 10¹²</td>
<td>10⁴</td>
<td>1</td>
<td>1.550 x 10⁹</td>
<td>1550</td>
<td>3.861 x 10⁷</td>
</tr>
<tr>
<td>1 mil²</td>
<td>= 645.16</td>
<td>6.452 x 10⁻⁶</td>
<td>6.452 x 10⁻¹⁰</td>
<td>1</td>
<td>10⁶</td>
<td>2.491 x 10⁻¹⁶</td>
</tr>
<tr>
<td>1 in.²</td>
<td>= 6.452 x 10⁸</td>
<td>6.452*</td>
<td>6.452 x 10⁻⁴</td>
<td>10⁶</td>
<td>1</td>
<td>2.491 x 10⁻¹⁰</td>
</tr>
<tr>
<td>1 mile²</td>
<td>= 2.590 x 10¹⁸</td>
<td>2.590 x 10¹⁰</td>
<td>2.590 x 10⁶</td>
<td>4.014 x 10¹⁵</td>
<td>4.014 x 10⁸</td>
<td>1</td>
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### Units of Volume

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<tr>
<th>Units</th>
<th>m³</th>
<th>cm³</th>
<th>liter</th>
<th>ln.³</th>
<th>ft³</th>
<th>qt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 m³</td>
<td>= 1</td>
<td>10⁶</td>
<td>10³</td>
<td>6.103 x 10⁴</td>
<td>35.3147</td>
<td>1.0567 x 10³</td>
</tr>
<tr>
<td>1 cm³</td>
<td>= 10⁻⁶</td>
<td>1</td>
<td>10⁻³</td>
<td>0.06103</td>
<td>3.532 x 10⁻⁵</td>
<td>1.0567 x 10⁻³</td>
</tr>
<tr>
<td>1 liter</td>
<td>= 10⁻³</td>
<td>1000*</td>
<td>1</td>
<td>61.0237</td>
<td>0.0353</td>
<td>1.0567</td>
</tr>
<tr>
<td>1 in.³</td>
<td>= 1.639 x 10⁻⁵</td>
<td>16.3871*</td>
<td>0.0164</td>
<td>1</td>
<td>5.787 x 10⁻⁴</td>
<td>0.0173</td>
</tr>
<tr>
<td>1 ft³</td>
<td>= 2.832 x 10⁻²</td>
<td>28316.85</td>
<td>28.31685</td>
<td>1728*</td>
<td>1</td>
<td>2.9922</td>
</tr>
<tr>
<td>1 qt</td>
<td>= 9.464 x 10⁻⁴</td>
<td>946.353</td>
<td>0.9464</td>
<td>57.75</td>
<td>0.0342</td>
<td>1</td>
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### Units of Mass

<table>
<thead>
<tr>
<th>Units</th>
<th>g</th>
<th>kg</th>
<th>oz</th>
<th>lb</th>
<th>metric ton</th>
<th>ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 g</td>
<td>= 1</td>
<td>10⁻³</td>
<td>0.0353</td>
<td>2.2046 x 10⁻³</td>
<td>10⁻⁶</td>
<td>1.1023 x 10⁻⁶</td>
</tr>
<tr>
<td>1 kg</td>
<td>= 1000</td>
<td>1</td>
<td>35.2740</td>
<td>2.2046</td>
<td>10⁻³</td>
<td>1.1023 x 10⁻³</td>
</tr>
<tr>
<td>1 oz</td>
<td>= 28.3495</td>
<td>0.0283</td>
<td>1</td>
<td>0.0625</td>
<td>2.8350 x 10⁻⁵</td>
<td>3.125 x 10⁻⁵</td>
</tr>
<tr>
<td>1 lb</td>
<td>= 453.5924</td>
<td>0.4536</td>
<td>16*</td>
<td>1</td>
<td>4.5359 x 10⁻⁴</td>
<td>0.0005</td>
</tr>
<tr>
<td>1 metric ton</td>
<td>= 10⁶</td>
<td>1000*</td>
<td>35273.96</td>
<td>2204.623</td>
<td>1</td>
<td>1.1023</td>
</tr>
<tr>
<td>1 ton</td>
<td>= 907184.7</td>
<td>907.1847</td>
<td>32000</td>
<td>2000*</td>
<td>0.9072</td>
<td>1</td>
</tr>
</tbody>
</table>

### Units of Density

<table>
<thead>
<tr>
<th>Units</th>
<th>g cm⁻³</th>
<th>g L⁻¹ (kg m⁻³)</th>
<th>oz in⁻³</th>
<th>lb ln⁻³</th>
<th>lb ft⁻³</th>
<th>lb gal⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>g cm⁻³</td>
<td>= 1</td>
<td>1000</td>
<td>0.5780</td>
<td>0.0361</td>
<td>62.4280</td>
<td>8.3454</td>
</tr>
<tr>
<td>g L⁻¹ (kg m⁻³)</td>
<td>= 10⁻³</td>
<td>1</td>
<td>5.7804 x 10⁻⁴</td>
<td>3.6127 x 10⁻⁵</td>
<td>0.0624</td>
<td>8.3454 x 10⁻³</td>
</tr>
<tr>
<td>oz in⁻³</td>
<td>= 1.7300</td>
<td>1729.994</td>
<td>1</td>
<td>0.0625</td>
<td>108</td>
<td>14.4375</td>
</tr>
<tr>
<td>lb in⁻³</td>
<td>= 27.6799</td>
<td>27679.91</td>
<td>16</td>
<td>1</td>
<td>1728</td>
<td>231</td>
</tr>
<tr>
<td>lb ft⁻³</td>
<td>= 0.0160</td>
<td>16.0185</td>
<td>9.2592 x 10⁻³</td>
<td>5.7870 x 10⁻⁴</td>
<td>1</td>
<td>0.1337</td>
</tr>
<tr>
<td>lb gal⁻¹</td>
<td>= 0.1198</td>
<td>119.8264</td>
<td>4.7495 x 10⁻³</td>
<td>4.3290 x 10⁻³</td>
<td>7.4805</td>
<td>1</td>
</tr>
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</table>

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Reprint Acknowledgments

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<thead>
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<tr>
<td>P.O. Box 248266</td>
</tr>
<tr>
<td>Coral Gables, FL 33124</td>
</tr>
</tbody>
</table>


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The Society of Automotive Engineers
400 Commonwealth Dr.
Warrendale, PA 15096-0001


SAE of Japan
10-2 Goban-cho
Chiyoda-ku
Tokyo 102
Japan


American Chemical Society
1155 Sixteenth Street, N.W.
Washington, D.C. 20036


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Headquarters
1700 S. Mt. Prospect Road
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