

# The Math of Chemistry

Name: \_\_\_\_\_

<p align="center"><b>Density</b></p> <p>You have a 23.6 g piece of gallium with a volume of 4.0 cm<sup>3</sup>. Calculate the density of gallium.</p>	<p align="center"><b>Density</b></p> <p>You have a 3.6 g piece of nickel. What is the volume of your piece? (use Table S to find density)</p>	<p align="center"><b>Density</b></p> <p>You have 12.4 ml of bromine. What is the mass of your sample? (use Table S to find density)</p>
<p align="center"><b>Percent Error</b></p> <p>A student calculated the density of iron to be 7.204. What is the student's percent error? (use Table S to find density)</p>	<p align="center"><b>Temperature</b></p> <p>A student heats water to a temperature of 69.8 °C. How many degrees Kelvin is this?</p>	<p align="center"><b>Temperature</b></p> <p>A sample of gas is heated to 401K. How many degrees Celsius is this?</p>
<p align="center"><b>% Composition by Mass</b></p> <p>A penny has a total mass of 3.1g. Zinc makes up 2.9 g of the penny. What is the % by mass of zinc in the penny?</p>	<p align="center"><b>% Composition by Mass</b></p> <p>C<sub>3</sub>H<sub>6</sub> has a total mass of 42 g. What is the % composition by mass of carbon in the compound?</p>	<p align="center"><b>Parts Per Million</b></p> <p>What is the concentration, in parts per million, of dissolved oxygen in a pond if a sample has 3.5 g of O<sub>2</sub> in every 147.1 g of pond water?</p>
<p align="center"><b>Combined Gas Law</b></p> <p>A sample of gas has a volume of 12L at 273K and 187.5 kPa. What will be the new volume when the pressure is changed to 300kPa and the temp. is changed to 375K.</p>	<p align="center"><b>Combined Gas Law</b></p> <p>A sample of gas at 101.3 kPa has a volume of 4.5L and a temp. of 86.2 °C. If the pressure is increased to 116 kPa and the volume is decreased to 3.5L, what will the new temp. be?</p>	<p align="center"><b>Combined Gas Law</b></p> <p>A sample of gas has a volume of 6L and a pressure of 1.5atm. If the pressure is increased to 2.0 atm, what will the new volume be?</p>
<p align="center"><b>Weighted Atomic Mass</b></p> <p>Boron has 2 natural isotopes: <sup>10</sup>B (10.013 amu) has 19.9% abundance, and <sup>11</sup>B (11.009 amu) has 80.1% abundance. Calculate the weighted atomic mass of Boron.</p>	<p align="center"><b>Empirical Formula</b></p> <p>What is the empirical formula of a compound that is 40% sulfur and 60% oxygen by weight? (hint: use a 100g sample to calculate)</p>	<p align="center"><b>Empirical Formula</b></p> <p>A hydrocarbon has a gram formula mass of 86 g/mol. What is the molecular formula of this compound? And, what is the empirical formula?</p>

# The Math of Chemistry

Name: \_\_\_\_\_

<p><b><i>Titration</i></b> A 25 mL solution of 0.5 M NaOH is titrated until neutralized into a 50 mL sample of HCl. What is the concentration of the HCl?</p>	<p><b><i>Radioactive Decay</i></b> A sample of <math>^{14}\text{C}</math> has a half life of 5730 years. How many half lives have elapsed after 14,000 years?</p>	<p><b><i>Radioactive Decay</i></b> The half life of <math>^{233}\text{U}</math> is <math>1.62 \times 10^5</math> years. How much time has elapsed after 2.5 half lives?</p>
<p><b><i>Heat</i></b> How much heat is required to melt a 45.8 g sample of ice?</p>	<p><b><i>Heat</i></b> If 42,000 J is required to vaporize a sample of water, what was the mass of the water?</p>	<p><b><i>Heat</i></b> How much heat is required to raise the temperature of 5.9 g of water from 50 °C to 80 °C?</p>
<p><b><i>Heat</i></b> If 9500 joules are added to 50g of liquid water at 20 °C, what will be the new temperature of the water?</p>	<p><b><i>Heat</i></b> How much heat will be liberated (given off) if 60g of water is cooled from 80 °C to 65 °C?</p>	<p><b><i>Heat</i></b> If a piece of hot metal is put into a 100g sample of liquid water at 25 °C, and the temperature of the water rises until it reaches 32 °C, how much heat energy did the metal lose?</p>
<p><b><i>Metric Conversion</i></b> A piece of glass tubing is 4.6m long. How many mm is this?</p> <p>Express your answer in proper scientific notation:</p>	<p><b><i>Metric Conversion</i></b> A liquid has a volume of 35.4 mL. How many liters is this?</p>	<p><b><i>Metric Conversion</i></b> A gardener buys a 2.50 kg bag of fertilizer. How many grams is this?</p>
<p><b><i>Metric Conversion</i></b> The pressure of a gas is recorded as 55,601 Pascals. How many kPa is this?</p>	<p><b><i>Metric Conversion</i></b> A chemist has 0.75 mg of mercury. How many grams is this?</p> <p>Express your answer in proper scientific notation:</p>	<p><b><i>Metric Conversion</i></b> If the density of liquid water is 1 g/cm<sup>3</sup>, and 1ml = 1cm<sup>3</sup>, what is the mass of 200ml of water?</p>

# The Math of Chemistry

Name: \_\_\_\_\_

<p><b>Pressure Conversion</b> A pressure of 154.7 kPa is equal to how many atmospheres?</p>	<p><b>Pressure Conversion</b> A pressure of 3.6 atm is equal to how many kPa?</p>	<p><b>Molar Mass/Gram Formula Mass</b> Calculate the gram formula mass of H<sub>2</sub>SO<sub>4</sub>.</p>
<p><b>Molar Mass/Gram Formula Mass</b> How many grams are in one mole of Ca(NO<sub>3</sub>)<sub>2</sub>?</p>	<p><b>Gram → Mole Conversions</b> If you have 372.6 grams of C<sub>2</sub>H<sub>8</sub>N, how many moles is this?</p>	<p><b>Gram → Mole Conversions</b> How many moles is a 43.9 gram sample of Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>?</p>
<p><b>Mole → Gram Conversions</b> A chemist wants to measure out exactly 5 moles of Magnesium. How many grams is this?</p>	<p><b>Mole → Gram Conversions</b> If I want exactly 1.567 moles of Fe<sub>2</sub>O<sub>3</sub>, how many grams would I measure out on a balance?</p>	<p><b>Mole → Mole Ratios</b> How many moles of oxygen react with 2.4 moles of iron in this reaction? <math display="block">4\text{Fe}_{(s)} + 3\text{O}_{2(g)} \rightarrow 2\text{Fe}_2\text{O}_{3(s)}</math></p>
<p><b>Mole → Mole Ratios</b> In this reaction, what is the ratio of moles of oxygen used to moles of CO<sub>2</sub> produced? <math display="block">2\text{CO}_{(g)} + \text{O}_{2(g)} \rightarrow 2\text{CO}_{2(g)}</math></p>	<p><b>Mole → Mole Ratios</b> How many moles of aluminum are needed to react completely with 1.2 mole of FeO? <math display="block">2\text{Al}_{(s)} + 3\text{FeO}_{(s)} \rightarrow 3\text{Fe}_{(s)} + \text{Al}_2\text{O}_{3(s)}</math></p>	<p><b>Mole → Mole Ratios</b> How many grams of hydrogen are needed to react with 3.2 moles of P<sub>4</sub>? <math display="block">\text{P}_{4(g)} + 6\text{H}_{2(g)} \rightarrow 4\text{PH}_{3(g)}</math></p>
<p><b>Molarity</b> What is the molarity of a solution that has 14.5 moles of NaCl dissolved into water to make 500ml of solution?</p>	<p><b>Molarity</b> How many moles of KCl will we need to make 2L of a 3.0M solution?  How many grams of KCl is this?</p>	<p><b>Molarity</b> What is the volume of a 4.0M solution of HCl made with 35.8 g of HCl?</p>

# The Math of Chemistry

Name: \_\_\_\_\_