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Moles

Directions: Show ALL of your work. Include all units and correct number of sig figs.

1. How many moles of iodine are present in 35.2 g of iodine?

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$$35.2 \text{ g I}_2 \times \frac{1 \text{ mol I}_2}{253.8 \text{ g I}_2} = 0.139 \text{ mol I}_2$$

2. What is the mass of 2.00 moles of liquid mercury?

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$$2.00 \text{ mol Hg} \times \frac{200.6 \text{ g Hg}}{1 \text{ mol Hg}} = 401 \text{ g Hg}$$

3. If an aluminum can has a mass of 13.96 g, how many aluminum atoms are present?

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$$13.96 \text{ g Al} \times \frac{1 \text{ mol Al}}{26.98 \text{ g Al}} \times \frac{6.02 \times 10^{23} \text{ Al atoms}}{1 \text{ mol Al}} = 3.115 \times 10^{23} \text{ Al atoms}$$

4. How many moles of iron (III) oxide (159.7) are present in 3.04×10^{21} iron (III) oxide particles?

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$$3.04 \times 10^{21} \text{ Fe}_2\text{O}_3 \text{ parts} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{6.02 \times 10^{23} \text{ Fe}_2\text{O}_3 \text{ parts}} = 5.05 \times 10^{-3} \text{ mol Fe}_2\text{O}_3$$

5. Calculate the moles of water (18.02) in 40.3 g of water.

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$$40.3 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} = 2.24 \text{ mol H}_2\text{O}$$

6. Determine the grams of calcium phosphate (310.2) in 21 moles of calcium phosphate.

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$$21 \text{ mol Ca}_3(\text{PO}_4)_2 \times \frac{310.2 \text{ g Ca}_3(\text{PO}_4)_2}{1 \text{ mol Ca}_3(\text{PO}_4)_2} = 6510 \text{ g Ca}_3(\text{PO}_4)_2$$

7. Calculate the moles of sucrose (342) present in 2.00×10^{27} molecules of sucrose.

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$$2.00 \times 10^{27} \text{ C}_{12}\text{H}_{22}\text{O}_{11} \text{ molecules} \times \frac{1 \text{ mol C}_{12}\text{H}_{22}\text{O}_{11}}{6.02 \times 10^{23} \text{ C}_{12}\text{H}_{22}\text{O}_{11} \text{ molecules}} = 3320 \text{ mol C}_{12}\text{H}_{22}\text{O}_{11}$$

8. If you obtained 7.34×10^{34} particles of calcium hydroxide (74.10), how many kilograms of calcium hydroxide would you have?

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$$7.34 \times 10^{34} \text{ Ca(OH)}_2 \text{ part} \times \frac{1 \text{ mol Ca(OH)}_2}{6.02 \times 10^{23} \text{ Ca(OH)}_2 \text{ part}} \times \frac{74.10 \text{ g Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 9.03 \times 10^9 \text{ kg Ca(OH)}_2$$

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9. How many moles of silver nitrate (169.9) are needed to make a solution that is 30.0 % by mass silver nitrate? Hint: assume that you have a 100. g sample.

$$30.0g \text{ AgNO}_3$$

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$$30.0g \text{ AgNO}_3 \times \frac{1 \text{ mol AgNO}_3}{169.9g \text{ AgNO}_3} = 0.177 \text{ mol AgNO}_3$$

10. Determine how many copper (II) sulfate pentahydrate particles are present in 50.0 lbs of copper (II) sulfate pentahydrate. 1 lb = 454 g

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$$50.0 \text{ lbs} \times \frac{454g \text{ CuSO}_4 \cdot 5\text{H}_2\text{O}}{1 \text{ lb}} \times \frac{1 \text{ mol CuSO}_4 \cdot 5\text{H}_2\text{O}}{249.7g \text{ CuSO}_4 \cdot 5\text{H}_2\text{O}} \times \frac{6.02 \times 10^{23} \text{ CuSO}_4 \cdot 5\text{H}_2\text{O particles}}{1 \text{ mol CuSO}_4 \cdot 5\text{H}_2\text{O}} = 5.47 \times 10^{25} \text{ CuSO}_4 \cdot 5\text{H}_2\text{O particles}$$

11. A 150. cm³ block of lead contains 8.11 moles of lead. What is the density of lead?

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$$D = \frac{m}{V} = \frac{1680g}{150. \text{ cm}^3} = \frac{11.2g}{\text{cm}^3}$$

$$m = 8.11 \text{ mol Pb} \times \frac{207.2g \text{ Pb}}{1 \text{ mol Pb}} = 1680g \text{ Pb}$$

12. The value of gold is \$ 797 per troy ounce. How many gold atoms are in \$3510 worth of gold? 1 troy oz = 31.1034768 g

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$$\$3510 \times \frac{1 \text{ troy oz}}{\$797} \times \frac{31.103g \text{ Au}}{1 \text{ troy oz}} \times \frac{1 \text{ mol Au}}{197.0g \text{ Au}} \times \frac{6.02 \times 10^{23} \text{ Au atoms}}{1 \text{ mol Au}} = 4.19 \times 10^{23} \text{ Au atoms}$$

13. Calculate the number of grams of iron that contain the same number of atoms as 2.24 g of cobalt.

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$$\frac{x \text{ g Fe}}{55.85g \text{ Fe}} = \frac{2.24 \text{ g Co}}{58.93g \text{ Co}}$$

$$x = 2.12g \text{ Fe}$$

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