Worksheet on Moles

Three conversions to remember about chemicals – usually used when we are asking about just one chemical:

1. How many atoms are in 40.08 grams of calcium?
2. One mole of magnesium would contain how many atoms?
3. How many atoms are in 5.55 moles of silver?
4. How many moles are in $5.55 \times 10^{33}$ molecules of $\text{H}_2\text{SO}_4$?
5. What is the molar mass of sodium carbonate?
6. What is the molar mass of nickel(III) sulfate?
7. How many moles are in 88.88 grams of calcium?
8. How many grams is 1.25 moles of potassium bromide?
9. 3.50 grams of gold would contain how many atoms?
10. How many liters is 0.975 moles of laughing gas at STP?
11. How many liters is $3.59 \times 10^{19}$ atoms of argon gas at STP?
12. What is the percent oxygen in sulfuric acid, $\text{H}_2\text{SO}_4$?
13. What is the percent hydrogen in water?
Answers

1. 40.08 grams of calcium is one mole (see Periodic Table), and one mole is 6.02 x 10^23 atoms.

2. One mole of anything is 6.02 x 10^23, so it is 6.02 x 10^23 Mg atoms.

3. 5.55 mol Ag \( \left( \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol}} \right) \) = 3.34 x 10^24 atoms Ag

4. 5.55 x 10^33 molecules \( \left( \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}} \right) \) = 9.22 x 10^9 moles H_2SO_4

5. Na_2CO_3 adding up the masses of all the atoms = 105.99 g/mol

6. Ni_2(SO_4)_3 is 405.59 g/mol

7. 88.88 g Ca \( \left( \frac{1 \text{ mol}}{40.08 \text{ g}} \right) \) = 2.218 mol Ca

8. 1.25 mol KBr \( \left( \frac{119.00 \text{ g}}{1 \text{ mol}} \right) \) = 149 grams

9. 3.50 g Au \( \left( \frac{1 \text{ mol}}{196.97 \text{ g}} \right) \left( \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol}} \right) \) = 1.07 x 10^22 atoms Au

10. 0.975 mol \( \left( \frac{22.4 L}{1 \text{ mol}} \right) \) = 21.8 L gas

11. 3.59 x 10^19 atoms Ar \( \left( \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \right) \left( \frac{22.4 L}{1 \text{ mol}} \right) \) = 0.00134 L Ar gas

12. Four oxygens = 64.00 grams, H_2SO_4 total = 98.09 grams.
   
   So percent oxygen is \( \left( \frac{64.00 \text{ g}}{98.09 \text{ g}} \right) \times 100\% = 65.25\% \)

13. Two hydrogens in water = 2.02 grams, H_2O = 18.02 grams
   
   So percent H is \( \left( \frac{2.02 \text{ g}}{18.02 \text{ g}} \right) \times 100\% = 11.2\% \)