

### Moles and Stoichiometry Practice Problems

**Directions:** On another sheet of paper, practice showing your work for full/ partial credit. If you're prepared and ready for the test, you should be able to do each problem in 5 minutes. Use significant figures.

1. Potassium thiosulfate ( $K_2S_2O_3$ ) is used to remove any excess chlorine from fibers and fabrics that have been bleached with that gas. The reaction is



- a. Balance this reaction.  
b. How many grams of  $K_2S_2O_3$  have to be used to get 25.0 grams of  $KHSO_4$ ? (Note: your answer to part a is needed.)  
c. How many grams of  $HCl$  will be produced if 25.0 grams of  $KHSO_4$  is also produced? (Note: your answer to part a is needed.)
2. The chemical formula of caffeine is  $C_8H_{10}N_4O_2$ .  
a. What is the ratio of nitrogen atoms to one molecule of caffeine? What is the mole ratio of nitrogen to 1 mole of caffeine? (Just write one possible ratio for each.)  
b. If caffeine is decomposed in the laboratory to obtain the element nitrogen, how many grams of nitrogen (N, not  $N_2$ ) would you expect from a 0.25 gram sample of caffeine?  
c. How many molecules of caffeine are there in 0.25 grams of caffeine?
3. Automotive airbags inflate when sodium azide ( $NaN_3$ ) rapidly decomposes to sodium and nitrogen.  
a. Write the balanced equation for this chemical reaction.  
b. The gaseous nitrogen that is generated inflates the airbag. How many moles of  $NaN_3$  would have to decompose in order to generate 253 million molecules of nitrogen?  
c. Please calculate the mass (in grams) of  $NaN_3$  that corresponds to the number of moles calculated in part b (you may still get full credit for part c if part b is not correct).
4. Liquid nitroglycerin, a very powerful explosive, has the formula  $C_3H_5(NO_3)_3$ . It is unstable and decomposes to form carbon dioxide, nitrogen, water, and oxygen.  
a. Write the balanced chemical equation for this decomposition. Write the starting materials on the left and the products on the right side of the arrow.  
HINT: Don't forget the diatomic molecules!  
b. How many grams of carbon dioxide are formed from 10.00 grams of liquid nitroglycerin? Use significant figures and show your work.
5. Macroscopic and microscopic worlds unite!  
a. How many grams of Si would contain the same number of atoms as there are in 2.10 moles of Ar?  
b. How many atoms are in 5.00 moles of argon?  
c.  $4.90 \times 10^{20}$  atoms of sodium is how many moles of sodium?  
d. How many grams of oxygen is in 0.10 grams of glucose ( $C_6H_{12}O_6$ )?

#### ANSWERS

1a) 1, 4, 5, 2, 8; b) 17.5g; c) 26.8g; 2a) 4:1 for both; b. 0.072 g; c.  $7.8 \times 10^{23}$  molecules; 3a) 2, 2, 3; b)  $2.80 \times 10^{-18}$  mol; c)  $1.82 \times 10^{11}$ g; 4a) 4, 12, 6, 10, 1 (or half of these); b) 5.813g; 5a) 59.0g; b)  $3.01 \times 10^{23}$  atoms; c) 814 mol; d) 0.033g.