

**MOLE WORKSHEET #2**

Make the following conversions using unit analysis. Use a separate piece of paper, show all work, and circle your final answer. (Attach this sheet to your work).

**Set A: One Step Problems:****Convert to moles:**

1.  $12.04 \times 10^{23}$  atoms He
2.  $3.01 \times 10^{23}$  atoms Cu
3.  $3.612 \times 10^{23}$  atoms Fe
4. 100 atoms Ar
5. 1 atom S
6. 24 grams C
7. 59.3 grams Sn
8. 98.9 grams Na
9. 5000 grams K
10. 0.005 grams Ne

**Convert to mass in grams:**

11. 10.0 moles Na
12. 2.20 moles Sn
13. 5.00 moles Ag
14.  $3.0 \times 10^{-4}$  moles Au
15.  $1.00 \times 10^{-7}$  moles B

**Convert to number of atoms:**

16. 3.00 moles Li
17. 8.50 moles Ca
18. 25.0 moles Kr
19. 0.001 moles Cd
20.  $1.0 \times 10^{-5}$  moles Al

**Set B: Two Step Problems:****Convert to mass in grams:**

21.  $6.02 \times 10^{23}$  atoms Ca
22.  $1.204 \times 10^{23}$  atoms Bi
23.  $3.01 \times 10^{23}$  atoms Ni
24. 1000 atoms Al
25. 1 atom Na

**Convert to number of atoms:**

26. 540 grams Al
27. 294 grams Au
28. 6.35 grams Cu
29. 2000 grams Mg
30. 1.00 gram Li

**ANSWERS:**

- 1) 2 mol 2) 0.50 mol 3) 0.60 mol 4)  $1.66 \times 10^{-22}$  mol 5)  $1.66 \times 10^{-24}$  mol 6) 2 mol  
 7) 0.50 mol 8) 4.3 mol 9) 127.9 mol 10)  $2.5 \times 10^{-4}$  mol 11) 230 g 12) 261.1 g 13)  
 539.5 g 14) 0.059 g 15)  $1.08 \times 10^{-6}$  g 16)  $1.8 \times 10^{24}$  atoms 17)  $5.12 \times 10^{24}$  atoms  
 18)  $1.51 \times 10^{25}$  atoms 19)  $6.02 \times 10^{20}$  atoms 20)  $6.02 \times 10^{18}$  atoms 21) 40.1 g 22)  
 41.8 g 23) 29.35 g 24)  $4.49 \times 10^{-20}$  g 25)  $3.82 \times 10^{-23}$  g 26)  $1.2 \times 10^{25}$  atoms 27)  
 $8.98 \times 10^{23}$  atoms 28)  $6.02 \times 10^{22}$  atoms 29)  $5.0 \times 10^{25}$  atoms 30)  $8.6 \times 10^{22}$  atoms

## Moles, Molecules, and Grams Worksheet

- 1) How many molecules are there in 24 grams of  $\text{FeF}_3$ ?
- 2) How many molecules are there in 450 grams of  $\text{Na}_2\text{SO}_4$ ?
- 3) How many grams are there in  $2.3 \times 10^{24}$  atoms of silver?
- 4) How many grams are there in  $7.4 \times 10^{23}$  molecules of  $\text{AgNO}_3$ ?
- 5) How many grams are there in  $7.5 \times 10^{23}$  molecules of  $\text{H}_2\text{SO}_4$ ?
- 6) How many molecules are there in 122 grams of  $\text{Cu}(\text{NO}_3)_2$ ?
- 7) How many grams are there in  $9.4 \times 10^{25}$  molecules of  $\text{H}_2$ ?
- 8) How many molecules are there in 230 grams of  $\text{CoCl}_2$ ?

- 9) How many molecules are there in 2.3 grams of  $\text{NH}_4\text{SO}_2$ ?
- 10) How many grams are there in  $3.3 \times 10^{23}$  molecules of  $\text{N}_2\text{I}_6$ ?
- 11) How many molecules are there in 200 grams of  $\text{CCl}_4$ ?
- 12) How many grams are there in  $1 \times 10^{24}$  molecules of  $\text{BCl}_3$ ?
- 13) How many grams are there in  $4.5 \times 10^{22}$  molecules of  $\text{Ba}(\text{NO}_2)_2$ ?
- 14) How many molecules are there in 9.34 grams of  $\text{LiCl}$ ?
- 15) How many grams do  $4.3 \times 10^{21}$  molecules of  $\text{UF}_6$  weigh?
- 16) How many molecules are there in 230 grams of  $\text{NH}_4\text{OH}$ ?

## Moles, Molecules, and Grams Worksheet – Answer Key

- 1) How many molecules are there in 24 grams of  $\text{FeF}_3$ ?  $1.28 \times 10^{23}$   
molecules
- 2) How many molecules are there in 450 grams of  $\text{Na}_2\text{SO}_4$ ?  $1.91 \times 10^{24}$   
molecules
- 3) How many grams are there in  $2.3 \times 10^{24}$  atoms of silver? 421 grams
- 4) How many grams are there in  $7.4 \times 10^{23}$  molecules of  $\text{AgNO}_3$ ? 209  
grams
- 5) How many grams are there in  $7.5 \times 10^{23}$  molecules of  $\text{H}_2\text{SO}_4$ ? 122 grams
- 6) How many molecules are there in 122 grams of  $\text{Cu}(\text{NO}_3)_2$ ?  $3.92 \times 10^{23}$   
molecules
- 7) How many grams are there in  $9.4 \times 10^{25}$  molecules of  $\text{H}_2$ ? 312 grams
- 8) How many molecules are there in 230 grams of  $\text{CoCl}_2$ ?  $1.07 \times 10^{24}$   
molecules
- 9) How many molecules are there in 2.3 grams of  $\text{NH}_4\text{SO}_2$ ?  $1.69 \times 10^{22}$   
molecules
- 10) How many grams are there in  $3.3 \times 10^{23}$  molecules of  $\text{N}_2\text{I}_6$ ? 430 grams
- 11) How many molecules are there in 200 grams of  $\text{CCl}_4$ ?  $7.82 \times 10^{23}$   
molecules
- 12) How many grams are there in  $1 \times 10^{24}$  molecules of  $\text{BCl}_3$ ? 195 grams
- 13) How many grams are there in  $4.5 \times 10^{22}$  molecules of  $\text{Ba}(\text{NO}_2)_2$ ? 17.1  
grams
- 14) How many molecules are there in 9.34 grams of  $\text{LiCl}$ ?  $1.33 \times 10^{23}$   
molecules
- 15) How many grams do  $4.3 \times 10^{21}$  molecules of  $\text{UF}_6$  weigh? 2.51 grams
- 16) How many molecules are there in 230 grams of  $\text{NH}_4\text{OH}$ ?  $3.96 \times 10^{24}$   
molecules

## Mole Practice

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

Date: \_\_\_\_\_

Avogadro's Number ( $6.02 \times 10^{23}$ ) was not discovered by him, but named in honor of him. It was Dr. Avogadro's original hypothesis about the volume of gas molecules that led to the development of the mole concept many years later.



The only known picture of  
Amedeo Avogadro

**Use your newfound molar repertoire to complete the following problems:**

- 1) What is the mass of 5.7 L of  $\text{NH}_3$  (g) at STP?
- 2) How many molecules are in 75.0 g of diphosphorus pentoxide?
- 3) What is the mass of 2.5 moles of  $\text{Cl}_2$  (g) at STP?
- 4) What volume is occupied by 55 g of methane,  $\text{CH}_4$  (g) at STP?
- 5) How many atoms of neon gas would a container with a volume of 67.2 L hold at STP?
- 6) Change 5.20 moles of  $\text{C}_3\text{H}_6\text{O}_2$  to grams.
- 7) Change 13.2 g of  $\text{Fe}(\text{NO}_3)_3$  to moles.
- 8) Change 13.2 g of  $\text{Sn}(\text{CO}_3)_2$  to moles.
- 9) How many molecules of ammonium chloride are in 54.5 g of ammonium chloride?

Q: What did Avogadro teach his students in math class?  
A: *Moltiplication!*

10) One drop of water weighs 0.040 g. How many molecules are there in one drop, taking the gram formula mass (molar mass) of water to be 18 g/mol?

11) Isopentyl acetate,  $C_7H_{14}O_2$ , the compound responsible for the scent of bananas, can be produced commercially. Interestingly, some bees release about 1  $\mu\text{g}$  ( $1 \times 10^{-6}$  g) of this compound when they sting. It is believed the resulting scent attracts other bees to join the attack. How many molecules of isopentyl acetate are released in a typical bee sting?

12) How many moles are there in 303 g of potassium nitrate? How many molecules are there?

13) A silicon chip used in an integrated circuit of a microcomputer has a mass of .006 g. How many silicon (Si) atoms are present in the chip?

#### Amedeo Avogadro Fun Facts!

- He was born in 1776; one month after the Declaration of Independence was signed.
- He received a degree in law at the age of 16.
- He had 6 children. (Yes, he was married, although his picture would make you think otherwise.)
- He was a chemistry professor at the University of Turin, which still exists in the city where the Winter Olympics were recently held.

# Mole Practice

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

Key

Date: \_\_\_\_\_

Avogadro's Number ( $6.02 \times 10^{23}$ ) was not discovered by him, but named in honor of him. It was Dr. Avogadro's original hypothesis about the volume of gas molecules that led to the development of the mole concept many years later.



The only known picture of Amedeo Avogadro

Use your newfound molar repertoire to complete the following problems:

- 1) What is the mass of 5.7 L of  $\text{NH}_3$  (g) at STP?

$$\frac{5.7\text{L}}{22.4\text{L}} \times \frac{1\text{mol}}{1\text{mol}} \times 17.03\text{g} = 4.3\text{g}$$

- 6) Change 5.20 moles of  $\text{C}_3\text{H}_6\text{O}_2$  to grams.

$$5.20\text{mol} \times \frac{74.08\text{g}}{1\text{mol}} = 385\text{g}$$

- 2) How many molecules are in 75.0 g of diphosphorus pentoxide?

$\text{P}_2\text{O}_5$

$$\frac{75.0\text{g}}{141.94\text{g}} \times 1\text{mol} = 0.528\text{mol}$$

- 7) Change 13.2 g of  $\text{Fe}(\text{NO}_3)_3$  to moles.

$$\frac{13.2\text{g}}{241.86\text{g}} \times 1\text{mol} = 0.0546\text{mol}$$

- 3) What is the mass of 2.5 moles of  $\text{Cl}_2$  (g) at STP?

$$\frac{2.5\text{mol Cl}_2}{1\text{mol Cl}_2} \times 70.9 = 177.25\text{g}$$

180

- 8) Change 13.2 g of  $\text{Sn}(\text{CO}_3)_2$  to moles.

$$\frac{13.2\text{g}}{288.73\text{g}} \times 1\text{mol} = 0.055\text{mol}$$

- 4) What volume is occupied by 55 g of methane,  $\text{CH}_4$  (g) at STP?

$$\frac{55\text{g}}{16.05\text{g}} \times \frac{1\text{mol}}{1\text{mol}} \times 22.4\text{L} = 77\text{L CH}_4$$

- 9) How many molecules of ammonium chloride are in 54.5 g of ammonium chloride?

$$\frac{54.5\text{g}}{53.49\text{g}} \times \frac{1\text{mol}}{1\text{mol}} \times 6.02 \times 10^{23}$$

$$6.13 \times 10^{23} \text{ molecules}$$

- 5) How many atoms of neon gas would a container with a volume of 67.2 L hold at STP?

$$\frac{67.2\text{L}}{22.4\text{L}} \times \frac{1\text{mol}}{1\text{mol}} \times 6.02 \times 10^{23} = 1.81 \times 10^{24} \text{ atoms}$$

$$1.81 \times 10^{24} \text{ atoms}$$

Q: What did Avogadro teach his students in math class?  
A: Multiplication!

10) One drop of water weighs 0.040 g. How many molecules are there in one drop, taking the gram formula mass (molar mass) of water to be 18 g/mol?

$$\frac{0.040 \text{ g}}{18 \text{ g}} \times \frac{1 \text{ mol}}{1 \text{ mol}} \times 6.02 \times 10^{23} = 1.34 \times 10^{22} \text{ molecules}$$

$$\boxed{1.3 \times 10^{22} \text{ molecules}}$$

11) Isopentyl acetate,  $C_7H_{14}O_2$ , the compound responsible for the scent of bananas, can be produced commercially. Interestingly, some bees release about 1  $\mu\text{g}$  ( $1 \times 10^{-6}$  g) of this compound when they sting. It is believed the resulting scent attracts other bees to join the attack. How many molecules of isopentyl acetate are released in a typical bee sting?

$$\frac{1 \times 10^{-6} \text{ g}}{130.19 \text{ g}} \times \frac{1 \text{ mol}}{1 \text{ mol}} \times 6.02 \times 10^{23} = 4.62 \times 10^{15} \text{ molecules}$$

12) How many moles are there in 303 g of potassium nitrate? How many molecules are there?

$$\frac{303 \text{ g } KNO_3}{101.10 \text{ g}} \times \frac{1 \text{ mol } KNO_3}{1 \text{ mol}} = 3.00 \text{ mol} \times 6.02 \times 10^{23} \text{ molecules}$$

$$\boxed{1.8 \times 10^{24} \text{ molecules}}$$

13) A silicon chip used in an integrated circuit of a microcomputer has a mass of .006 g. How many silicon (Si) atoms are present in the chip?

$$\frac{0.006 \text{ g}}{28.09 \text{ g}} \times \frac{1 \text{ mol}}{1 \text{ mol}} \times 6.02 \times 10^{23} \text{ atoms} = 1.2 \times 10^{20} \text{ atoms}$$

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