**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:**

<table>
<thead>
<tr>
<th>Convert to moles:</th>
<th>Convert to mass in grams:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 12.04 x 10^{23} atoms He</td>
<td>11. 10.0 moles Na</td>
</tr>
<tr>
<td>2. 3.01 x 10^{23} atoms Cu</td>
<td>12. 2.20 moles Sn</td>
</tr>
<tr>
<td>3. 3.612 x 10^{23} atoms Fe</td>
<td>13. 5.00 moles Ag</td>
</tr>
<tr>
<td>4. 100 atoms Ar</td>
<td>14. 3.0 x 10^{-4} moles Au</td>
</tr>
<tr>
<td>5. 1 atom S</td>
<td>15. 1.00 x 10^{-7} moles B</td>
</tr>
<tr>
<td>6. 24 grams C</td>
<td><strong>Convert to number of atoms:</strong></td>
</tr>
<tr>
<td>7. 59.3 grams Sn</td>
<td>16. 3.00 moles Li</td>
</tr>
<tr>
<td>8. 98.9 grams Na</td>
<td>17. 8.50 moles Ca</td>
</tr>
<tr>
<td>9. 5000 grams K</td>
<td>18. 25.0 moles Kr</td>
</tr>
<tr>
<td>10. 0.005 grams Ne</td>
<td>19. 0.001 moles Cd</td>
</tr>
<tr>
<td></td>
<td>20. 1.0 x 10^{-5} moles Al</td>
</tr>
</tbody>
</table>

**Set B: Two Step Problems:**

<table>
<thead>
<tr>
<th>Convert to mass in grams:</th>
<th>Convert to number of atoms:</th>
</tr>
</thead>
<tbody>
<tr>
<td>21. 6.02 x 10^{23} atoms Ca</td>
<td>26. 540 grams Al</td>
</tr>
<tr>
<td>22. 1.204 x 10^{23} atoms Bi</td>
<td>27. 294 grams Au</td>
</tr>
<tr>
<td>23. 3.01 x 10^{23} atoms Ni</td>
<td>28. 6.35 grams Cu</td>
</tr>
<tr>
<td>24. 1000 atoms Al</td>
<td>29. 2000 grams Mg</td>
</tr>
<tr>
<td>25. 1 atom Na</td>
<td>30. 1.00 gram Li</td>
</tr>
</tbody>
</table>

**ANSWERS:**

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

1) How many molecules are there in 24 grams of FeF₃?

2) How many molecules are there in 450 grams of Na₂SO₄?

3) How many grams are there in 2.3 x 10²⁴ atoms of silver?

4) How many grams are there in 7.4 x 10²³ molecules of AgNO₃?

5) How many grams are there in 7.5 x 10²³ molecules of H₂SO₄?

6) How many molecules are there in 122 grams of Cu(NO₃)₂?

7) How many grams are there in 9.4 x 10²⁵ molecules of H₂?

8) How many molecules are there in 230 grams of CoCl₂?
9) How many molecules are there in 2.3 grams of NH$_4$SO$_2$?

10) How many grams are there in $3.3 \times 10^{23}$ molecules of N$_2$I$_6$?

11) How many molecules are there in 200 grams of CCl$_4$?

12) How many grams are there in $1 \times 10^{24}$ molecules of BCl$_3$?

13) How many grams are there in $4.5 \times 10^{22}$ molecules of Ba(NO$_2$)$_2$?

14) How many molecules are there in 9.34 grams of LiCl?

15) How many grams do $4.3 \times 10^{21}$ molecules of UF$_6$ weigh?

16) How many molecules are there in 230 grams of NH$_4$OH?
<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How many molecules are there in 24 grams of FeF₃?</td>
<td>$1.28 \times 10^{23}$ molecules</td>
</tr>
<tr>
<td>2</td>
<td>How many molecules are there in 450 grams of Na₂SO₄?</td>
<td>$1.91 \times 10^{24}$ molecules</td>
</tr>
<tr>
<td>3</td>
<td>How many grams are there in $2.3 \times 10^{24}$ atoms of silver?</td>
<td>421 grams</td>
</tr>
<tr>
<td>4</td>
<td>How many grams are there in $7.4 \times 10^{23}$ molecules of AgNO₃?</td>
<td>209 grams</td>
</tr>
<tr>
<td>5</td>
<td>How many grams are there in $7.5 \times 10^{23}$ molecules of H₂SO₄?</td>
<td>122 grams</td>
</tr>
<tr>
<td>6</td>
<td>How many molecules are there in 122 grams of Cu(NO₃)₂?</td>
<td>$3.92 \times 10^{23}$ molecules</td>
</tr>
<tr>
<td>7</td>
<td>How many grams are there in $9.4 \times 10^{25}$ molecules of H₂?</td>
<td>312 grams</td>
</tr>
<tr>
<td>8</td>
<td>How many molecules are there in 230 grams of CoCl₂?</td>
<td>$1.07 \times 10^{24}$ molecules</td>
</tr>
<tr>
<td>9</td>
<td>How many molecules are there in 2.3 grams of NH₄SO₂?</td>
<td>$1.69 \times 10^{22}$ molecules</td>
</tr>
<tr>
<td>10</td>
<td>How many grams are there in $3.3 \times 10^{23}$ molecules of N₂I₆?</td>
<td>430 grams</td>
</tr>
<tr>
<td>11</td>
<td>How many molecules are there in 200 grams of CCl₄?</td>
<td>$7.82 \times 10^{23}$ molecules</td>
</tr>
<tr>
<td>12</td>
<td>How many grams are there in $1 \times 10^{24}$ molecules of BCl₃?</td>
<td>195 grams</td>
</tr>
<tr>
<td>13</td>
<td>How many grams are there in $4.5 \times 10^{22}$ molecules of Ba(NO₂)₂?</td>
<td>17.1 grams</td>
</tr>
<tr>
<td>14</td>
<td>How many molecules are there in 9.34 grams of LiCl?</td>
<td>$1.33 \times 10^{23}$ molecules</td>
</tr>
<tr>
<td>15</td>
<td>How many grams do $4.3 \times 10^{21}$ molecules of UF₆ weigh?</td>
<td>2.51 grams</td>
</tr>
<tr>
<td>16</td>
<td>How many molecules are there in 230 grams of NH₄OH?</td>
<td>$3.96 \times 10^{24}$ molecules</td>
</tr>
</tbody>
</table>
Mole Practice

Avogadro’s Number (6.02 x 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.

Use your newfound molar repertoire to complete the following problems:

1) What is the mass of 5.7 L of 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 Cl_{2} (g) at STP?

4) What volume is occupied by 55 g of methane, 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 C_{3}H_{5}O_{2} to grams.

7) Change 13.2 g of Fe(NO_{3})_{3} to moles.

8) Change 13.2 g of Sn(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: Moletiplication!
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, C₇H₁₄O₂, the compound responsible for the scent of bananas, can be produced commercially. Interestingly, some bees release about 1 ug (1 x 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 0.006 g. How many silicon (Si) atoms are present in the chip?

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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.
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.

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

1) What is the mass of 5.7 L of NH$_3$ (g) at STP?

$$\frac{5.7 \text{ mol}}{22.4 \text{ L/mol}} \times \frac{17.03 \text{ g}}{1 \text{ mol}} = 4.39 \text{ g}$$

6) Change 5.20 moles of C$_3$H$_6$O$_2$ to grams.

$$\frac{5.20 \text{ mol}}{1 \text{ mol}} \times \frac{74.08 \text{ g}}{1 \text{ mol}} = 385.4 \text{ g}$$

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

$$\frac{75.0 \text{ g}}{141.98 \text{ g/mol}} = 0.528 \text{ mol}$$

7) Change 13.2 g of Fe(NO$_3$)$_3$ to mol.

$$\frac{13.2 \text{ g}}{241.8 \text{ g/mol}} = 0.0546 \text{ mol}$$

3) What is the mass of 2.5 moles of Cl$_2$ (g) at STP?

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

8) Change 13.2 g of Sn(CO$_3$)$_2$ to mol.

$$\frac{13.2 \text{ g}}{233.7 \text{ g/mol}} = 0.0561 \text{ mol}$$

4) What volume is occupied by 55 g of methane, CH$_4$ (g) at STP?

$$\frac{55 \text{ g}}{16.04 \text{ g/mol}} \times \frac{22.4 \text{ L/mol}}{1 \text{ mol}} = 677 \text{ LCH}_4$$

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

$$\frac{54.5 \text{ g}}{1 \text{ mol}} \times \frac{6.02 \times 10^{23}}{153.49 \text{ g}} = 0.13 \times 10^{23} \text{ molecules}$$

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

$$\frac{67.2 \text{ L}}{22.4 \text{ L/mol}} \times \frac{1 \text{ mol}}{1 \text{ mol}} = 3 \times 10^{24} \text{ atoms}$$

---

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

\[
\frac{0.040 \text{ g}}{18 \text{ g/mol}} \times 6.02 \times 10^{23} \text{ molecules/mol} = 1.34 \times 10^{22} \text{ molecules}
\]

11) Isopentyl acetate, C₇H₁₄O₂, the compound responsible for the scent of bananas, can be produced commercially. Interestingly, some bees release about 1 ug (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?

\[
\frac{1 \times 10^{-6} \text{ g}}{130.19 \text{ g/mol}} \times 16.02 \times 10^{23} \text{ molecules/mol} = 4.62 \times 10^{15} \text{ molecules}
\]

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

\[
\frac{303 \text{ g KNO₃}}{101.10 \text{ g/mol}} \times 1 \text{ mol KNO₃} = 3.00 \text{ mol KNO₃} \times 6.02 \times 10^{23} \text{ molecules/mol}
\]
\[
= 1.80 \times 10^{26} \text{ molecules}
\]

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?

\[
\frac{0.006 \text{ g}}{28.09 \text{ g/mol}} \times 6.02 \times 10^{23} \text{ atoms/mol} = 1.20 \times 10^{20} \text{ atoms}
\]

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**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.
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