THE MOLE AND AVOGADRO'S NUMBER

Name Answer Key

One mole of a substance contains Avogadro's Number (6.02×10^{23}) of molecules.

How many molecules are in the quantities below?

1. $2.0 \text{ moles} \left| \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \right. = 1.2 \times 10^{24} \text{ molec}$

2. $1.5 \text{ moles} \left| \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \right. = 9.0 \times 10^{23} \text{ molec}$

3. $0.75 \text{ mole} \left| \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \right. = 4.5 \times 10^{23} \text{ molec}$

4. $15 \text{ moles} \left| \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \right. = 9.0 \times 10^{24} \text{ molec}$

5. $0.35 \text{ mole} \left| \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \right. = 2.1 \times 10^{23} \text{ molec}$

How many moles are in the number of molecules below?

1. $6.02 \times 10^{23} \text{ atoms} \left| \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \right. = 1.00 \text{ mol}$

2. $1.204 \times 10^{24} \text{ molec} \left| \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molec}} \right. = 2.000 \text{ mol}$

3. $1.5 \times 10^{20} \text{ molec} \left| \frac{1 \text{ mol}}{6.02 \cdot 10^{23} \text{ molec}} \right. 2.5 \times 10^{-4} \text{ mol}$

4. $3.4 \times 10^{26} \text{ atoms} \left| \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \right. = 560 \text{ mol}$

5. $7.5 \times 10^{19} \text{ atoms} \left| \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atom}} \right. = 1.2 \times 10^{-4} \text{ mol}$

GRAM FORMULA MASS / Molar mass

Name _____

Determine the gram formula mass (the mass of one mole) of each compound below.

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1. [redacted] Potassium permanganate — 158.04 g/mol
2. [redacted] potassium chloride — 74.55 g/mol
3. [redacted] sodium sulfate — 142.05 g/mol
4. [redacted] calcium nitrate — 164.10 g/mol
5. [redacted] aluminum sulfate — 342.17 g/mol
6. [redacted] ammonium phosphate — 149.12 ~~132.17~~ g/mol
7. $CuSO_4 \cdot 5H_2O$ — 249.72 g/mol
8. [redacted] magnesium phosphate — 262.87 g/mol
9. $Zn(C_2H_3O_2)_2 \cdot 2H_2O$ — 219.53 g/mol
10. $Zn_3(PO_4)_2 \cdot 4H_2O$ — 458.19 g/mol
11. [redacted] Hydrogen carbonate — 62.03 g/mol
12. $Hg_2Cr_2O_7$ — 617.18 g/mol
13. $Ba(ClO_3)_2$ — 304.23 g/mol
14. $Fe_2(SO_3)_3$ — 351.91 g/mol
15. $NH_4C_2H_3O_2$ — 77.10 g/mol

MOLES AND MASS

Name _____

Determine the number of moles in each of the quantities below.

1. 25 g of NaCl $\left|\frac{1\ mol}{58.45\ g}\right.$ = .43 mol NaCl

2. 125 g of H_2SO_4 $\left|\frac{1\ mol}{98.09\ g}\right.$ = 1.27 mol H_2SO_4

3. 100. g of $KMnO_4$ $\left|\frac{1\ mol}{158.04\ g}\right.$ = .633 mol $KMnO_4$

4. 74 g of KCl $\left|\frac{1\ mol}{74.55\ g}\right.$ = .99 mol KCl

5. 35 g of $CuSO_4 \cdot 5H_2O$ $\left|\frac{1\ mol}{249.72\ g}\right.$ = .14 mol $CuSO_4 \cdot 5H_2O$

Determine the number of grams in each of the quantities below.

1. 2.5 moles of NaCl $\left|\frac{58.45\ g}{1\ mol}\right.$ = 146 = 150 g NaCl

2. 0.50 moles of H_2SO_4 $\left|\frac{98.09\ g}{1\ mol}\right.$ = 49 g H_2SO_4

3. 1.70 moles of $KMnO_4$ $\left|\frac{158.04\ g}{1\ mol}\right.$ = 269 g $KMnO_4$

4. 0.25 moles of KCl $\left|\frac{74.55\ g}{1\ mol}\right.$ = 19 g KCl

5. 3.2 moles of $CuSO_4 \cdot 5H_2O$ $\left|\frac{249.72\ g}{1\ mol}\right.$ = 8.0×10^2 g $CuSO_4 \cdot 5H_2O$

THE MOLE AND VOLUME

Name _____

For gases at STP (273 K and 1 atm pressure), one mole occupies a volume of 22.4 L. What volume will the following quantities of gases occupy at STP?

1. 1.00 mole of H_2 $\left|\frac{22.4\ L}{1\ mol}\right.$ = 22.4 L H_2

2. 3.20 moles of O_2 $\left|\frac{22.4\ L}{1\ mol}\right.$ = 71.7 L O_2

3. 0.750 mole of N_2 $\left|\frac{22.4\ L}{1\ mol}\right.$ = 16.8 L N_2

4. 1.75 moles of CO_2 $\left|\frac{22.4\ L}{1\ mol}\right.$ = 39.2 L CO_2

5. 0.50 mole of NH_3 $\left|\frac{22.4\ L}{1\ mol}\right.$ = 11 L NH_3

6. 5.0 g of H_2 $\left|\frac{1\ mol\ H_2}{2.02\ g\ H_2}\right|\frac{22.4\ L}{1\ mol}$ = 55 L H_2

7. 100. g of O_2 $\left|\frac{1\ mol}{32.00\ g}\right|\frac{22.4\ L}{1\ mol}$ = 70.0 L O_2

8. 28.0 g of N_2 $\left|\frac{1\ mol}{28.02\ g\ N_2}\right|\frac{22.4\ L}{1\ mol}$ = 22.4 L N_2

9. 60. g of CO_2 $\left|\frac{1\ mol}{44.01\ g}\right|\frac{22.4\ L}{1\ mol}$ = 31 L CO_2

10. 10. g of NH_3 $\left|\frac{1\ mol}{17.04\ g\ NH_3}\right|\frac{22.4\ L}{1\ mol}$ = 13 L NH_3

MIXED MOLE PROBLEMS

Name _____

Solve the following problems.

1. How many grams are there in 1.5×10^{25} molecules of CO_2?

1.5×10^{25} molec CO_2 | 1 mol | 44.01 g
$6.02 \cdot 10^{23}$ molec | 1 mol

1.1×10^{3} g CO_2

2. What volume would the CO_2 in Problem 1 occupy at STP?

1.5×10^{25} molec CO_2 | 1 mol | 22.4 L
6.02×10^{23} molec | 1 mol

560 L CO_2

3. A sample of NH_3 gas occupies 75.0 liters at STP. How many molecules is this?

75.0 L NH_3 | 1 mol | 6.02×10^{23} molec
22.4 L | 1 mol

2.02×10^{24} molec

4. What is the mass of the sample of NH_3 in Problem 3?

75.0 L NH_3 | 1 mol | 17.04 g
22.4 L | 1 mol

57.1 g NH_3

5. How many atoms are there in 1.3×10^{22} molecules of NO_2?

3 atoms

1.3×10^{22} molec NO_2 | 3 atoms
1 molec NO_2

3.9×10^{22} atoms

6. A 5.0 g sample of O_2 is in a container at STP. What volume is the container?

5.0 g O_2 | 1 mol | 22.4 L
32.00 g O_2 | 1 mol

=

3.5 L O_2

7. How many molecules of O_2 are in the container in Problem 6? How many atoms of oxygen?

5.0 g O_2 | 1 mol | 6.02×10^{23} molec
32.00 g | 1 mol

9.4×10^{22} molec O_2

9.4×10^{22} molec O_2 | 2 atoms O
1 molec O_2

1.9×10^{23} atoms O

MOLE CONVERSIONS