Warm Up

Calculate the mass of 0.905 moles of sodium phosphate.

Na^+

PO_4^{3-}

$m = (M_m)(n)$

$= (163.94\ g/_{mol})(0.905)$

$= 148.37\ g$

m = ?

n = 0.905

Na_3PO_4

Na -> 3 x 22.99

P -> 1 x 30.97

O -> 4 x 16.00

163.94 g/mol

Homework

Mole-Volume Relationship

Avagadro's Hypothesis
Equal volumes of gases at the same temperature and pressure contain equal number of particles.

Standard temperature and pressure (STP)
0.^{o}C and 101.3kPa

SATP

At STP, 1 mol (6.02 x10^{23} representative particles) of any gas contains 22.4 L.

V_m @ STP = 22.4 L/mol

Calculating Volume at STP

Ex. Determine the volume of oxygen gas 0.375 mol will occupy at STP.

$n = 0.375\ mol$

$V = ?$

$0.375\ mol \times \frac{22.4\ L}{1\ mol} = 8.4\ L$

Ex. Determine the number of moles of helium gas found in 21.8 L at STP.

$V = 21.8\,L$

$n = ?$

$21.8\,\cancel{L} \times \frac{1\,mol}{22.4\,\cancel{L}} = \frac{21.8}{22.4}\,mol$

$= 0.973\,mol$

$0.973\,mol$

Cl_2

A sample of chlorine gas has a mass of 0.756 kg. What volume will this mass of gas occupy at STP?

$m = 0.756\,kg = 756\,g$

$V = ?$

2 steps: mass → mol

mol → V

① $756\,g \times \frac{1\,mol}{70.90\,g} = 10.7\,mol$

Cl_2

$2 \times 35.45 = 70.90\,g/mol$

② $10.7\,mol \times \frac{22.4\,L}{1\,mol} = 240.\,L$

Molar calculations worksheet

1. 8.97×10^{-3} mol
2. 1.49×10^{25} atoms
3. 5.42×10^{24} atoms
4. 46.01 g/mol
5. 14 300 mol
6. 342.34 g/mol
7. 159.70 g/mol
8. 4.24×10^{24} molecules
9. 1.79×10^{25} atoms
10. 643 g
11. 0.266 mol
12. 10 900 g
13. 6.26 mol