

Review Problems: Moles

1. Which of the following is not the same number as the rest? (Show your work below)

- a. The number of molecules in 4 moles of CO₂.
- b. The number of hydrogen atoms in 2 moles of H₂O.
- c. The number of chloride ions in 4 moles of CaCl₂.
- d. The number of hydrogen atoms in 1/2 mole of C₃H₈.

a) $4 \text{ mol CO}_2 \times \frac{6.022 \times 10^{23} \text{ molec CO}_2}{1 \text{ mol CO}_2} = 2.409 \times 10^{24} \text{ molec CO}_2$

b) $2 \text{ mol H}_2\text{O} \times \frac{6.022 \times 10^{23} \text{ molec H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \times \frac{2 \text{ atoms H}}{1 \text{ molec H}_2\text{O}} = 2.409 \times 10^{24} \text{ atoms H}$

c) $4 \text{ mol CaCl}_2 \times \frac{6.022 \times 10^{23} \text{ f.u. CaCl}_2}{1 \text{ mol CaCl}_2} \times \frac{2 \text{ Cl}^- \text{ ions}}{1 \text{ f.u. CaCl}_2} = 4.818 \times 10^{24} \text{ ions Cl}^-$

2. The mass in grams for one carbon-12 atom is:

12 g/mol

d) $\frac{1}{2} \text{ mol C}_3\text{H}_8 \times \frac{6.022 \times 10^{23} \text{ molec C}_3\text{H}_8}{1 \text{ mol C}_3\text{H}_8} \times \frac{8 \text{ atoms H}}{1 \text{ molec C}_3\text{H}_8} = 2.409 \times 10^{24} \text{ atoms H}$

3. The mass in u (or amu) for one carbon-12 atoms is:

12u

4. The formula of gold (III) chloride is AuCl₃. How many formula units are there in 0.30 moles of gold (III) chloride? How many atoms of chlorine are present in this same sample?

$0.30 \text{ mol AuCl}_3 \times \frac{6.022 \times 10^{23} \text{ f.u. AuCl}_3}{1 \text{ mol AuCl}_3} = 1.8 \times 10^{23} \text{ f.u. AuCl}_3$

$1.8 \times 10^{23} \text{ f.u. AuCl}_3 \times \frac{3 \text{ atoms Cl}}{1 \text{ AuCl}_3 \text{ F.U.}} = 5.4 \times 10^{23} \text{ Cl Atoms}$

5. A sample of phosphoric acid, H₃PO₄, contains 1.2 x 10²³ molecules.

a) How many moles of phosphoric acid is this?

$\frac{1.2 \times 10^{23} \text{ molec}}{6.022 \times 10^{23} \text{ molec/mol}} = 0.19926 \rightarrow 0.20 \text{ mol H}_3\text{PO}_4$

b) How many atoms of phosphorus will there be?

$0.20 \text{ mol H}_3\text{PO}_4 \times \frac{1 \text{ mol P}}{1 \text{ mol H}_3\text{PO}_4} \times \frac{6.022 \times 10^{23} \text{ atoms P}}{1 \text{ mol P}} = 1.2 \times 10^{23} \text{ atoms P}$

c) How many atoms of hydrogen will it contain?

$0.20 \text{ mol H}_3\text{PO}_4 \times \frac{3 \text{ mol H}}{1 \text{ mol H}_3\text{PO}_4} \times \frac{6.022 \times 10^{23} \text{ atoms H}}{1 \text{ mol H}} = 3.6 \times 10^{23} \text{ atoms H}$

