

CHEQ 1094 MOLES PROBLEM SET: ANSWERS

1. (a) $\text{mols} = 3.00 \times 10^{23} \text{ atoms} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} = 0.498 \text{ mol}$
- (b) $\text{mols} = 8.72 \times 10^{15} \text{ molecules} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}} = 1.45 \times 10^{-8} \text{ mol}$
- (c) $\text{mols} = 5.0 \times 10^{24} \text{ formula units} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ formula units}} = 8.3 \text{ mols}$
- (d) $\text{mols} = 15.0 \text{ g Na}_2\text{CO}_3 \times \frac{1 \text{ mol}}{106 \text{ g Na}_2\text{CO}_3} = 0.142 \text{ mol}$
- (e) $\text{mols} = 38.4 \text{ g NiCl}_2 \cdot 6\text{H}_2\text{O} \times \frac{1 \text{ mol}}{237.6 \text{ g NiCl}_2 \cdot 6\text{H}_2\text{O}} = 0.162 \text{ mol}$
- (f) $\text{mols} = 2.45 \text{ mg Si} \times \frac{1 \text{ g Si}}{10^3 \text{ mg Si}} \times \frac{1 \text{ mol}}{28.1 \text{ g Si}} = 8.72 \times 10^{-5} \text{ mol}$
2. (a) $\text{mass} = 2.50 \text{ mols Al} \times \frac{27.0 \text{ g Al}}{1 \text{ mol Al}} = 67.5 \text{ g Al}$
- (b) $\text{mass} = 0.500 \text{ mol CaCO}_3 \times \frac{100.1 \text{ g CaCO}_3}{1 \text{ mol CaCO}_3} = 50.1 \text{ g CaCO}_3$
- (c) $\text{mass} = 6.47 \times 10^{-2} \text{ mol N}_2\text{O}_3 \times \frac{76.0 \text{ g N}_2\text{O}_3}{1 \text{ mol N}_2\text{O}_3} = 4.92 \text{ g N}_2\text{O}_3$
- (d) $\text{mass} = 8.8 \times 10^{-5} \text{ mol H}_2 \times \frac{2.016 \text{ g H}_2}{1 \text{ mol H}_2} = 1.77 \times 10^{-4} \text{ g H}_2$
- (e) $\text{mass} = 1.15 \times 10^{20} \text{ formula units LiNO}_3 \times \frac{68.94 \text{ g LiNO}_3}{6.02 \times 10^{23} \text{ formula units LiNO}_3} = 0.0132 \text{ g LiNO}_3$
- (f) $\text{mass} = 6.02 \times 10^{30} \text{ atoms Hg} \times \frac{200.6 \text{ g Hg}}{6.02 \times 10^{23} \text{ atoms Hg}} = 2.01 \times 10^9 \text{ g Hg}$
- (g) $\text{mass} = 1.0 \times 10^{10} \text{ molecules ICl}_5 \times \frac{304 \text{ g ICl}_5}{6.02 \times 10^{23} \text{ molecules ICl}_5} = 5.05 \times 10^{-12} \text{ g ICl}_5$

3. (a) molar masses: $\text{KBr} = 39.1 + 79.9 = 119 \text{ g/mol}$
 $\text{AgNO}_3 = 107.9 + 14.0 + 3(16.0) = 169.9 \text{ g/mol}$

(b) $\text{mass KBr} = 0.0200 \text{ mol} \times \frac{119 \text{ g}}{1 \text{ mol}} = 2.38 \text{ g}$

$$\text{mass AgNO}_3 = 0.0200 \text{ mol} \times \frac{169.9 \text{ g}}{1 \text{ mol}} = 3.40 \text{ g}$$

4. (a) $\text{atoms} = 2.56 \text{ mols P}_4 \times \frac{4 \text{ mols atoms}}{1 \text{ mol P}_4} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol atoms}} = 6.16 \times 10^{24} \text{ atoms}$

(b) $\text{Cl}^- \text{ ions} = 55.0 \text{ g CaCl}_2 \times \frac{1 \text{ mol CaCl}_2}{111 \text{ g CaCl}_2} \times \frac{2 \text{ mols Cl}^- \text{ ions}}{1 \text{ mol CaCl}_2} \times \frac{6.02 \times 10^{23} \text{ Cl}^- \text{ ions}}{1 \text{ mol Cl}^- \text{ ions}}$
 $= 5.97 \times 10^{23} \text{ Cl}^- \text{ ions}$

(c) $\text{mols O atoms} = 22.5 \text{ g Al(NO}_3)_3 \times \frac{1 \text{ mol Al(NO}_3)_3}{213 \text{ g Al(NO}_3)_3} \times \frac{9 \text{ mols O atoms}}{1 \text{ mol Al(NO}_3)_3}$
 $= 0.951 \text{ mols O atoms}$

(d) $\text{mass Na}_2\text{SO}_4 = 0.035 \text{ mol Na}^+ \times \frac{1 \text{ mol Na}_2\text{SO}_4}{2 \text{ mols Na}^+} \times \frac{142 \text{ g Na}_2\text{SO}_4}{1 \text{ mol Na}_2\text{SO}_4} = 2.5 \text{ g Na}_2\text{SO}_4$

(e) $\text{mass Al(NO}_3)_3 = 8.6 \times 10^{28} \text{ NO}_3^- \text{ ions} \times \frac{1 \text{ mol NO}_3^- \text{ ions}}{6.02 \times 10^{23} \text{ NO}_3^- \text{ ions}} \times \frac{1 \text{ mol Al(NO}_3)_3}{3 \text{ mols NO}_3^- \text{ ions}} \times$
 $\frac{213 \text{ g Al(NO}_3)_3}{1 \text{ mol Al(NO}_3)_3} = 1.0 \times 10^7 \text{ g Al(NO}_3)_3$