

Mole Problems #2 - Answer Key

1.a) Mole - a unit of amount represented by 6.02×10^{23} particles.

b) Avogadro's Number = 6.02×10^{23}

c) The molar mass has the same value as the molecular mass but is expressed in GRAMS/mol rather than a.m.u.

$$2. \frac{0.842 \text{ mol } C_{14}H_{18}N_2O_5}{1 \text{ mol } C_{14}H_{18}N_2O_5} \times \frac{294 \text{ g } C_{14}H_{18}N_2O_5}{1 \text{ mol } C_{14}H_{18}N_2O_5} = \boxed{248 \text{ g aspartame}}$$

$$3. \frac{65.7 \text{ g } C_{14}H_{18}N_2O_5}{294.0 \text{ g } C_{14}H_{18}N_2O_5} \times \frac{1 \text{ mol } C_{14}H_{18}N_2O_5}{1 \text{ mol } C_{14}H_{18}N_2O_5} = \boxed{0.223 \text{ mol aspartame}}$$

$$4. \frac{1.25 \times 10^{20} \text{ molec. } C_8H_{10}N_4O_2}{6.02 \times 10^{23} \text{ molec. } C_8H_{10}N_4O_2} \times \frac{1 \text{ mol } C_8H_{10}N_4O_2}{1 \text{ mol } C_8H_{10}N_4O_2} \times \frac{194.0 \text{ g } C_8H_{10}N_4O_2}{1 \text{ mol } C_8H_{10}N_4O_2} = \boxed{0.0403 \text{ g caffeine}}$$

$$5. \frac{25 \mu\text{g } C_{21}H_{30}O_2}{10^6 \mu\text{g}} \times \frac{1 \text{ g}}{314.0 \text{ g } C_{21}H_{30}O_2} \times \frac{1 \text{ mol } C_{21}H_{30}O_2}{1 \text{ mol } C_{21}H_{30}O_2} = \boxed{8.0 \times 10^{-8} \text{ mol THC}}$$

$$6. \frac{25 \mu\text{g } C_{21}H_{30}O_2}{10^6 \mu\text{g}} \times \frac{1 \text{ g}}{314.0 \text{ g } C_{21}H_{30}O_2} \times \frac{1 \text{ mol } C_{21}H_{30}O_2}{1 \text{ mol } C_{21}H_{30}O_2} \times \frac{6.02 \times 10^{23} \text{ molec. } C_{21}H_{30}O_2}{1 \text{ mol } C_{21}H_{30}O_2} = \boxed{4.8 \times 10^{16} \text{ molecules THC}}$$

$$7. \frac{3.0 \times 10^{22} \text{ molec. } C_{27}H_{46}O}{6.02 \times 10^{23} \text{ molec. } C_{27}H_{46}O} \times \frac{1 \text{ mol } C_{27}H_{46}O}{1 \text{ mol } C_{27}H_{46}O} \times \frac{386.0 \text{ g } C_{27}H_{46}O}{1 \text{ mol } C_{27}H_{46}O} = \boxed{19 \text{ g cholesterol}}$$

$$8. \frac{500.0 \text{ mg } C_6H_8O_6}{10^3 \text{ mg}} \times \frac{1 \text{ g}}{176.0 \text{ g } C_6H_8O_6} \times \frac{1 \text{ mol } C_6H_8O_6}{1 \text{ mol } C_6H_8O_6} \times \frac{6.02 \times 10^{23} \text{ molec. } C_6H_8O_6}{1 \text{ mol } C_6H_8O_6} = \boxed{1.71 \times 10^{21} \text{ molec. Vit. C}}$$

$$9. \frac{100.0 \text{ mg } C_8H_9O_2N}{10^3 \text{ mg}} \times \frac{1 \text{ g}}{151.0 \text{ g } C_8H_9O_2N} \times \frac{1 \text{ mol } C_8H_9O_2N}{1 \text{ mol } C_8H_9O_2N} \times \frac{6.02 \times 10^{23} \text{ molec. } C_8H_9O_2N}{1 \text{ mol } C_8H_9O_2N} \times \frac{8 \text{ atoms}}{1 \text{ molecule}} = \boxed{3.19 \times 10^{21} \text{ atoms C}}$$

$$10. \frac{28.9 \text{ g Pentylacetate (PA)}}{10^3 \text{ mg}} \left| \frac{1 \text{ mol PA}}{130.0 \text{ g PA}} \right| \frac{6.02 \times 10^{23} \text{ molec. PA}}{1 \text{ mol PA}} \left| \frac{14 \text{ atoms H}}{1 \text{ molec. PA}} \right| = 1.82 \times 10^{21} \text{ atoms H}$$

$$11. \frac{1.0 \times 10^{20} \text{ atoms H}}{24 \text{ atoms H}} \left| \frac{1 \text{ molec. C}_{18}\text{H}_{24}\text{O}_2}{24 \text{ atoms H}} \right| = 4.2 \times 10^{18} \text{ molecules estradiol}$$

$$12. \frac{4.2 \times 10^{18} \text{ molec. C}_{18}\text{H}_{24}\text{O}_2}{6.02 \times 10^{23} \text{ molec. C}_{18}\text{H}_{24}\text{O}_2} \left| \frac{1 \text{ mol C}_{18}\text{H}_{24}\text{O}_2}{6.02 \times 10^{23} \text{ molec. C}_{18}\text{H}_{24}\text{O}_2} \right| = 7.0 \times 10^{-6} \text{ mol estradiol}$$

$$13. \frac{5.08 \text{ g C}_7\text{H}_6\text{O}_2}{122.0 \text{ g C}_7\text{H}_6\text{O}_2} \left| \frac{1 \text{ mol C}_7\text{H}_6\text{O}_2}{122.0 \text{ g C}_7\text{H}_6\text{O}_2} \right| = 0.0416 \text{ mol benzoic acid}$$

$$14. \frac{5.0 \text{ mol Cl}_2}{1 \text{ mol Cl}_2} \left| \frac{22.4 \text{ L Cl}_2}{1 \text{ mol Cl}_2} \right| = 112 \text{ L Cl}_2 = 1.1 \times 10^2 \text{ L Cl}_2$$

$$15. \frac{4.0 \times 10^{24} \text{ molec. F}_2}{6.02 \times 10^{23} \text{ molec. F}_2} \left| \frac{1 \text{ mol F}_2}{6.02 \times 10^{23} \text{ molec. F}_2} \right| \left| \frac{22.4 \text{ L F}_2}{1 \text{ mol F}_2} \right| = 1.5 \times 10^2 \text{ L F}_2$$

$$16. \frac{1 \text{ molec. (NH}_4)_2\text{SO}_4}{1 \text{ molec. (NH}_4)_2\text{SO}_4} \left| \frac{8 \text{ atoms H}}{1 \text{ molec. (NH}_4)_2\text{SO}_4} \right| = 8 \text{ atoms H}$$