

The Big Four: Mole Pre-Test Supplement

- a.) 2,7,8-trimethyl-2-(4,8,12-trimethyltridecyl)chroman-6-ol or more commonly, Vitamin E has the formula: $C_{28}H_{48}O_2$. If a person consumes 5.8×10^{22} molecules of Vitamin E how many grams would they consume?
 $5.8 \times 10^{22} / 6.02 \times 10^{23} = 0.0963 \text{ mol Vitamin E}$, $0.0963 \text{ mol Vit E} \times 28 = \text{mol C}$
 $2.696 \text{ mol C} \times 12 = \mathbf{40. \text{ g C}}$
- b.) A chemist produced 100.0 grams of naphthalene, 1-pentadecyl- ($C_{25}H_{38}$). What volume of H_2 gas at STP could be produced from the complete decomposition of this compound?
 $100 \text{ g N} / 338 \text{ g/mol} = 0.296 \text{ mol N}$, $0.296 \text{ mol N} \times 38 = \text{mol H}$, $/2 = \text{mol } H_2$ $\times 22.4 =$
 $\mathbf{125.9 \text{ L } H_2}$
- c.) Analysis of DDT, $C_{14}H_9Cl_5$, found that 5.77×10^{-6} grams of Cl_2 (diatomic) were detected in a water tank. How many grams and molecules of DDT were present?
 Cl_2 : $5.77 \times 10^{-6} / 71 \text{ g/mol} = 8.13 \times 10^{-8} \text{ mol } Cl_2 = (x2) = 1.625 \times 10^{-7} \text{ mol Cl}$
Since there are 15 mole Cl in one mole of DDT divide $1.625 \times 10^{-7} \text{ mol Cl}$ by 15 to get mol of DDT and convert back to grams of DDT using molar mass of 709.5 g
 $\mathbf{\text{Answer: } 7.69 \times 10^{-6} \text{ g DDT} = 6.52 \times 10^{15} \text{ molecules}}$
- d.) 4H-1-Benzopyran-4-one, 5-hydroxy-7-methoxy-2-phenyl has a molecular mass of 268 g/mol and is composed only of C, H, and O. If a 63.0g sample of 4H-1-Benzopyran-4-one, 5-hydroxy-7-methoxy-2-phenyl produces 31.59L of H_2 and 10.53L of O_2 at STP. What is the empirical and molecular formula of this compound?
For H_2 : $31.59 \text{ L} = 1.410 \text{ mol } H_2 = 2.821 \text{ mol H} = 2.821 \text{ g H}$
For O_2 : $10.53 \text{ L} = 0.470 \text{ mol } O_2 = 0.9402 \text{ mol O} = 15.04 \text{ g O}$
For C: $H + O = 63.0 \text{ g} - (2.821 \text{ g} + 15.04 \text{ g}) = 45.14 \text{ g C} = 3.762 \text{ mol}$
 $\mathbf{\text{Empirical Formula} = C_4H_3O \quad \text{Molecular Formula} = C_{16}H_{12}O_4}$