Mole Problems #2

1. The MOLE is a key concept in chemistry.
   a. Define the term ‘mole.’
   b. What is Avogadro’s number?
   c. What is the relationship between the molecular mass and the molar mass of a compound?

2. Aspartame ("Nutrasweet" or "Equal") is an artificial sweetener (sugar substitute). Its molecular formula is C_{14}H_{18}N_{2}O_{5}. What is the mass of 0.842 mol of Aspartame?

3. How many moles are present in 65.7 g of Aspartame?

4. What is the mass of 1.25 x 10^{20} molecules of Caffeine (C_{8}H_{10}N_{4}O_{2})?

5. About 25 µg of tetrahydrocannabinol (T.H.C.), the active ingredient in marijuana, is required to induce intoxication. Its molecular formula is C_{21}H_{30}O_{2}. How many moles does 25 µg of T.H.C. represent?

6. How many molecules are present in 25 µg of T.H.C.?

7. What would be the mass of 3.0 x 10^{22} molecules of cholesterol (C_{27}H_{46}O)?

8. How many molecules in a 500.0 mg tablet of Vitamin C (Ascorbic Acid) (C_{6}H_{8}O_{6})?

9. How many carbon atoms are present in a 100.0 mg tablet of Paracetamol (Acetominophen) (C_{8}H_{9}O_{2}N), the active ingredient in Tylenol?

10. How many hydrogen atoms would be found in 28.0 mg of Pentoyletate (CH_{3}CO_{2}C_{3}H_{11}), the compound that causes the odour in bananas?

11. A sample of the female sex hormone Estradiol (estrogen) (C_{18}H_{24}O_{2}) contains 1.0 x 10^{20} atoms of hydrogen. How many molecules of Estradiol would it contain?

12. How many moles of Estradiol are represented by the answer to Question #11?

13. How many moles are present in 5.08 g of Benzoic Acid (C_{7}H_{6}O_{2}), a food preservative?

14. What would be the volume of 5.0 mol of Cl_{2} gas at STP?

15. What volume would 4.0 x 10^{24} molecules of F_{2} gas occupy at STP?

16. How many hydrogen atoms are present in one molecule of Ammonium sulfate?