Determine the empirical and molecular formulas:

1. What's the empirical formula of a molecule containing 65.5% carbon, 5.5% hydrogen, and 29.0% oxygen?

C_3H_3O

2. If the molar mass of the compound in problem 1 is 110 grams/mole, what's the molecular formula?

$C_6H_6O_2$

3. What's the empirical formula of a molecule containing 18.7% lithium, 16.3% carbon, and 65.0% oxygen?

Li_2CO_3

4. If the molar mass of the compound in problem 3 is 73.8 grams/mole, what's the molecular formula?

Li_2CO_3

Write the molecular formulas of the following compounds:

5. A compound with an empirical formula of C_2OH_4 and a molar mass of 88 grams per mole.

$C_4O_2H_8$

6. A compound with an empirical formula of C_4H_4O and a molar mass of 136 grams per mole.

$C_8H_8O_2$

7. A compound with an empirical formula of CFBrO and a molar mass of 254.7 grams per mole.

$C_2F_2Br_2O_2$

8. A compound with an empirical formula of C_2H_8N and a molar mass of 46 grams per mole.

C_2H_8N

Answer the following questions:

9. The percentage composition of acetic acid is found to be 39.9% C, 6.7% H, and 53.4% O. Determine the empirical formula of acetic acid.

CH_2O

10. The molar mass for question #9 was determined by experiment to be 60.0 g/mol. What is the molecular formula?

$C_2H_4O_2$

11. Aniline, a starting material for urethane plastic foams, consists of C, H, and N. Combustion of such compounds yields CO_2, H_2O, and N_2 as products. If the combustion of 9.71 g of aniline yields 6.63 g H_2O and 1.46 g N_2, what is its empirical formula?

omit. typographical error.

12. The molar mass of aniline is 93 g/mol. What is its molecular formula?

omit.

13. Calculate the mass percent of carbon, nitrogen and oxygen in acetamide, C_2H_5NO.

C = 46% N = 24% O = 27%.

14. A 50.51 g sample of a compound made from phosphorus and chlorine is decomposed. Analysis of the products showed that 11.39 g of phosphorus atoms were produced. What is the empirical formula of the compound?

PCl_3

15. When 2.5000 g of an oxide of mercury, (Hg_xO_y) is decomposed into the elements by heating, 2.405 g of mercury are produced. Calculate the empirical formula.

Hg_2O

16. The compound benzamide has the following percent composition. What is the empirical formula?

C = 69.40 % H= 5.825 % O = 13.21 % N= 11.57 %

C_7H_7ON

17. A component of protein called serine has an approximate molar mass of 100 g/mole. If the percent composition is as follows, what is the empirical and molecular formula of serine?

C = 34.95 % H= 6.844 % O = 46.56 % N= 13.59 %

molecular = $C_3H_7O_3N$

&

empirical

Calculate the mass of the element in the given mass of compound:

18. Mass of Hydrogen in 350 g C_2H_6

70g

19. Mass of Oxygen in 20.2 g of $NaHSO_4$

10.77g

20. Mass of Hydrogen in 124 g of $Ca(C_2H_3O_2)_2$

4.74 g

21. Mass of Nitrogen in 378 g HCN

195.8 g.

22. Mass of Oxygen in 100 g H_2O

88.8 g.

Identify the following as molecular formulas, empirical formulas or both.

23. Ribose, $C_5H_{10}O_5$, a sugar molecule in RNA. molecular

24. Ethyl butanoate, $C_6H_{12}O_2$, a compound with the odor of pineapple. molecular

25. Chlorophyll, $C_{55}H_{72}MgN_4O_5$, part of photosynthesis. both.

26. DEET, $C_{12}H_{17}ON$, an insect repellent. both

27. Oxalic acid $H_2C_2O_4$, found in spinach and tea. molecular

Calculate the percent compositions:

28. How many grams of carbon, hydrogen, and oxygen are present in a 5 pound (2260 g) bag of sugar? The formula for sucrose is $C_{12}H_{22}O_{11}$.

C = 951 g O = 1162 g H = 146 g.

29. How many grams of sodium, hydrogen, carbon, and oxygen are present in a one-pound (454 g) box of baking soda (sodium bicarbonate, $NaHCO_3$)?

N = 124 g H = 5.45 g C = 64.91 g O = 259.4 g.

30. Milk of magnesia is a medication used to treat constipation, upset stomach, and heartburn. It is made of magnesium hydroxide ($Mg(OH)_{2)}$. How many grams of each element are present in a bottle (466 g)?

Mg = 194 g O = 255 g H = 16 g.

31. How many grams of each element would be present in a 1 Liter (1050 g) bottle of pure vinegar (acetic acid, $C_2H_4O_2$)?

C = 420 g H = 70.5 g O = 559.5 g.

32. A box of iron nails that have all completely rusted through has a mass of 85 g. What is the mass of each element within the rust? Rust is iron (III) oxide, Fe_2O_3.

Fe = 59.4 g O = 25.5 g.

Calculate the empirical formula, molecular formula, or both.

33. A compound has an empirical formula of NO2 and a molar mass of 92g/mol. Calculate the molecular formula.

N_2O_4

34. A compound has an empirical formula of C2H3O and a molar mass of 172g/mol. Calculate the molecular formula.

$C_8H_{12}O_4$

35. Ibuprofen has an empirical formula of C7H9O and a molar mass of 215g/mol. Calculate the molecular formula.

$C_{14}H_{18}O_2$

36. Nicotine is 74.1% carbon, 17.3% nitrogen, and 8.6% hydrogen by mass. It has a molar mass of 160g/mol.

$C_{10}H_{14}N_2$

37. Adrenaline is a hormone in the body. It is 59.0% carbon, 7.1% hydrogen, 26.2% oxygen, and 7.7% nitrogen. It has a molar mass of 180g/mol.

$C_9H_{13}O_3N$

38. A compound consists of 91.63 grams of carbon, 7.69 grams of hydrogen and 40.81 grams of oxygen. Its molar mass is 220g/mol. Determine the empirical and molecular formulas.

$C_{12}H_{12}O_4$

39. A compound has a molar mass of approximately 90 g/mol. Analysis reveals that a sample contains 16.10 g carbon, 3.36g hydrogen and 10.71 grams of oxygen.

$C_4H_{10}O_2$

Determine the empirical and molecular formula:

40. Hydrogenated fats are produced by passing hydrogen gas over long saturated carbon chains. A biochemist starts with 211.4 grams of pure carbon. After hydrogenation, the sample weighs 249.4 grams. The molecular mass of the product is roughly 100 AMU. Determine the empirical and molecular formulas.

omit.

Determine the molar mass:

41. L-glutamic acid: $C_5H_9NO_4$ 147.13 g/mol

42. 8-thiotheophyllinate-triphenylphosphine gold: $C_{24}H_{20}AuN_4O_2PS$

656.45 g/mol.

43. 1,4-difluorobenzene-krypton: $C_6H_4F_2K$

197.89 g/mole if Kr was used; 153.19 if K was used.

44. L-arabinose: $C_{14}H_{22}N_2O_{16}P_2$

536.28 g/mol.

45. Levodopa: $C_9H_{11}NO_4$

197.19 g/mol.