Chemical Compounds Practice Problems

1) What is the molecular, empirical, structural, and condensed structural formula for each of the following molecules: 1) _____

A) methane

B) ethane

C) ethyne

D) propene

E) methanol

F) ethanol

G) butanal

2) Which of the following must be an empirical formula? 2) _____

A) $C_{10}H_{14}N_2$ (nicotine) B) $C_9H_8O_4$ (aspirin)

C) $C_6H_8O_6$ (vitamin c) D) $C_8H_{10}N_4O_2$ (caffeine)

3) What is the empirical formula for fumaric acid, $C_4H_4O_4$? 3) _____

4) A 2.000 g sample of water contains 11.19% H by mass and 88.81% O by mass. What % of H by mass will be found in a 6.375 g sample of water? 4) _____

A) 5.60% B) 88.81% C) 33.33% D) 33.57% E) 11.19%

5) Determine percent H by mass in NH_4Cl. 5) _____

6) What is the mass percent of H_2O in magnesium chloride hexahydrate? 6) _____

7) The molecular formula of caffeine is $C_8H_{10}N_4O_2$. What is the mass percent of carbon, hydrogen, nitrogen, and oxygen in this molecule? 7) _____

8) A compound was found to be comprised of 21.955% sulfur and 78.045% fluorine by mass. What is its empirical formula? What is its molecular formula? 8) _____

9) A compound was found to be comprised of 21.955% sulfur and 78.045% fluorine by mass. Using a mass spectrometer this compound was found to have a mass of 146.056 g/mol. What is its molecular formula? 9) _____

10) A sample contains 43.7% phosphorus and 56.3% oxygen. What is the empirical formula of the compound? 10) _____

11) A compound was found to be comprised of 36.763% iron, 21.108% sulfur and 42.128% oxygen by mass. What is its empirical formula? 11) _____

12) A sample contains 43.7% phosphorus and 56.3% oxygen by mass. The molar mass is 283.89 amu. What is the molecular formula of the compound? 12) _____

13) White phosphorus (P_4), spontaneously ignites in oxygen. If 6.500 g of white phosphorus reacts with oxygen to form 11.54 g of a phosphorus oxide, what is the empirical formula of this oxide? 13) _____

A) P_2O_3 B) P_2O_6 C) PO_3 D) P_4O_6

14) The empirical formula of a substance is found to be CH_2O. If its molecular weight is found to be approximately 93 g/mol, what is the exact molecular weight of this substance? 14) _____

15) Styrene has a percent composition by mass of 92.26% carbon and 7.74% hydrogen. If 1.41×10^{22} styrene molecules weigh 2.44 grams, what is the molecular formula of styrene? 15) _____

A) CH B) C_2H_2 C) C_6H_6 D) C_8H_8 E) C_4H_4

16) A sample of pure copper weighing 3.178 gram is burned in the pressence of oxygen until it is all converted to a black oxide. The resultant black powder weighs 3.978 g. What is the formula of the oxide? 16) _____

A) CuO_2 B) Cu_2O C) CuO_3 D) CuO E) Cu_2O_3

17) How many atoms of potassium are in 1.00×10^2 g of potassium dichromate? 17) _____

18) How many micrograms of chromium are found in 65.456 mg of chromium(III)perchlorate hexahydrate? 18) _____

19) How many hydrogen atoms are there in 12.4 g of aluminum hydrogen phosphate? 19) _____

20) Complete combustion of a 0.500 g sample of a pure hydrocarbon yielded 0.973 g CO_2 and 0.319 g H_2O. What is the empirical formula of this hydrocarbon? 20) _____

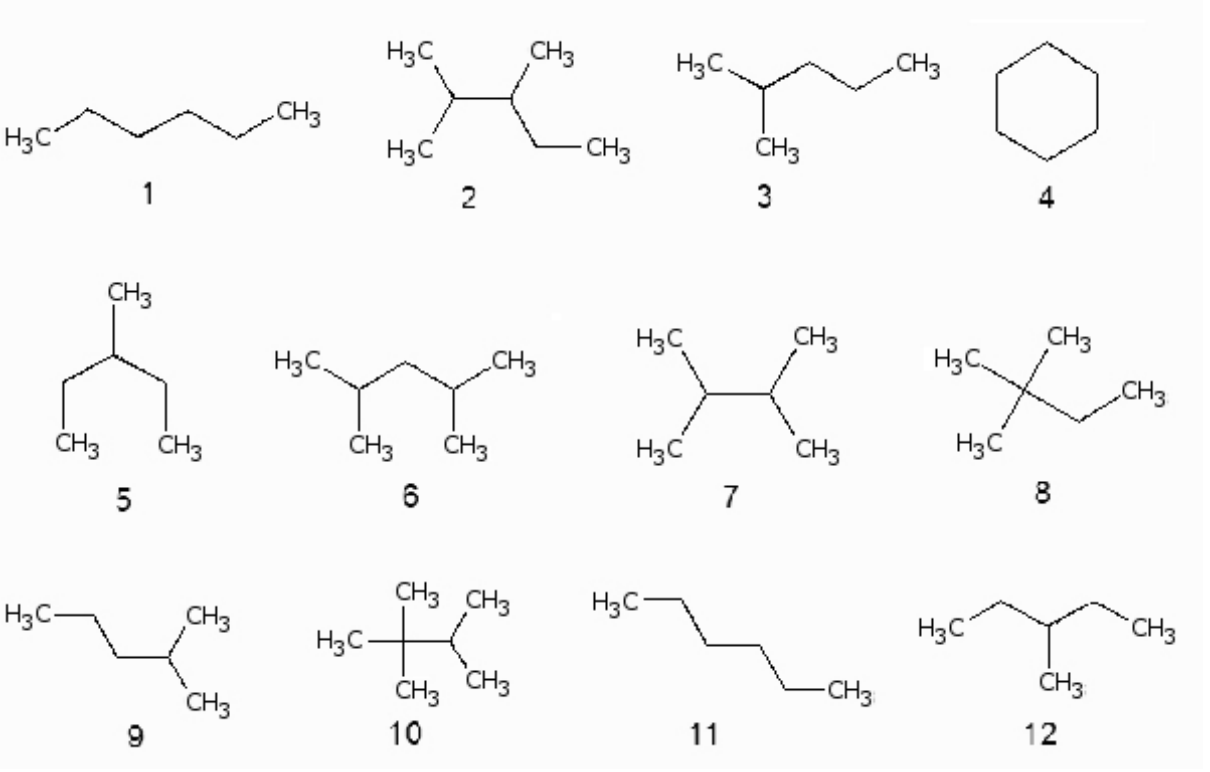
21) A 4.055 g sample of a compound containing only C, H, and O was burned completely. The only combustion products were 10.942 g CO_2 and 4.476 g H_2O. What is the empirical formula of the compound? 21) _____

22) What mass (in mg) of 3-chloro-2-pentanol will yield exactly 1 mmol of this compound? 22) _____

23) How many micrograms of cupric phosphate will provide 354.6 picomoles of copper? 23) _____

24) How many mL of ethanol are needed to provide 1.00×10^2 millimoles of oxygen? The density of ethanol is 0.789 g/mL 24) _____

25) Name each of the following hydrocarbons.



26) What is the correct name for the following organic structures. 26) _____

A) $CH_2{=}CHCH_2CH(CH_3)CH_3$

B) $CH_3CH_2CHBrCH_2CH_3$

C) $CH_3CH(OH)CH_2CH_2CH_2CH_3$

D) $CH_3CH_2CH_2CHClCH_2CH_2CH_2COOH$

E) $CH_2{=}CHCH(CH3)C(CH_3)_3$

F) $CH_2{=}CHCH(CH_2CH_3)CH(CH_3)_2CH3$