

1. **Draw structural formulas for seven different isomers of $C_3H_4Cl_2$**

Note: This one is HIGHLY HIGHLY HIGHLY probable, but there are no answers yet. FIND THE ANSWER TO THIS YOURSELF.

2. Suppose that a molecule has the formula AB_3 . Sketch and name two different shapes that this molecule may have. For each of the two shapes, give an example of a known molecule that has that shape. For one of the molecules you have named, interpret the shape in the context of a modern bonding theory.

3. Nitric acid is prepared commercially from atmospheric nitrogen. Write equations for the successive reactions involved and discuss the conditions for the industrial success of the overall process.

4. Comment on the structure of the dichlorotetramminechromium(III) ion.

5. Assume that you have two different gases that you know are not cyclic (i.e., not ring) compounds, each with the following elementary analysis: C, 85.7 per cent; H, 14.3 per cent. Each gas has a molecular weight of 56 ± 1 .

(a) What is the molecular formula for the compounds?

(b) Draw the structural formulas for the four possible noncyclic isomers with this molecular formula.

(c) In the presence of an appropriate catalyst, both gases add hydrogen. The hydrogenated products are identical, their molecular weight is 58. Which of the structures you drew to answer (b) can definitely be eliminated on the basis of this additional information?

ANSWER:

a) 3 points

Per 100 g of compound

$$85.7 \text{ g C} \times (1 \text{ mole C} / 12.0 \text{ g C}) = 7.14 \text{ mol C}$$

$$14.3 \text{ g H} \times (1 \text{ mol H} / 1.01 \text{ g H}) = 14.2 \text{ mol H}$$

Empirical formula is CH_2

Molecular formula is C_4H_8

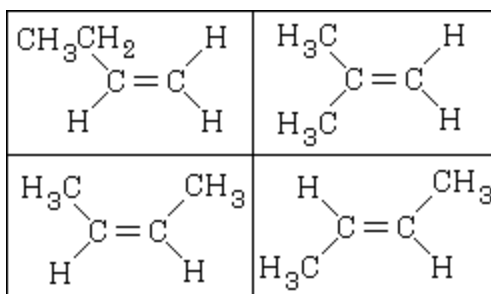
or

$$(56 \text{ g / mol}) \times 0.857 = 48 \text{ g / mol C}$$

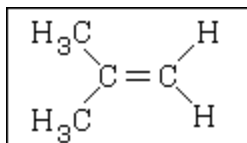
$$(56 \text{ g / mol}) \times 0.143 = 8.0 \text{ g / mol H}$$

$$48 / 12 = C_4 \text{ and } 8.0 / 1.0 = H_8$$

b) 4 points, one point for each correct structure



c) one point



6. How many isomers are there of the compound whose molecular formula is $\text{C}_2\text{H}_2\text{Cl}_2$? Describe how the various isomers differ from one another.

Note: Another highly probable one. Once again, no freaking answer...

7. What type of isomerism are possible among the molecules that can be obtained by substituting a chlorine atom and a bromine atom for two of the hydrogen atoms in each of the following.

(a) Ethane, C_2H_6 Show structures to illustrate each of the types of isomerism

(b) Ethene, C_2H_4 you name for each of these compounds.

Note: Once again, NO FREAKING ANSWERS!!!!!!

8. Write structural formulas for two stable isomers X and Y that have the molecular formula $\text{C}_2\text{H}_4\text{O}_2$. Select a physical property and a chemical property that would distinguish between the two isomers in the laboratory. Explain.

9. Consider the types of isomerism for molecules with the formula C_6H_{12} . Illustrate each of three types by structural formulas. What structural features are essential for the existence of each of these types of isomerism?

10. Dehydration of 3-hexanol yields a mixture of four isomers each with the molecular formula C_6H_{12} . Draw structures of the four isomers and name each of them.

11. Briefly discuss the following statement:

"The functional group concept is important in organizing the information of organic chemistry."

Support your discussion by giving two chemical equations to illustrate the application of this concept for each of two functional groups.

12. Draw the structures for four of the isomers of C_4H_6 .