

NAMING ALKANES WORKSHEET

Purpose: The purpose of this assignment is to apply the concepts of structural and chemical properties of alkanes. This assignment will help to increase your familiarity with IUPAC rules for naming and drawing alkanes.

Student Learning Outcomes addressed in this assignment:

After completing this worksheet, you will be able to:

- Generate names for simple hydrocarbons: alkanes.
- Construct the chemical structure of substituted alkane molecules.

Assignment: Read the introduction material and complete the problems that follow. The answers are provided at the end of the worksheet.

Criteria: This is a practice assignment and will not be graded. Points will not be earned or deducted for completing or not completing this worksheet.

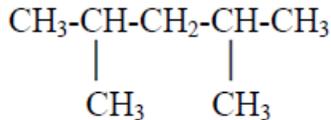
Introduction

The International Union of Pure and Applied Chemistry (IUPAC) nomenclature system is based on naming the longest chain of carbon atoms connected by single bonds in a molecule. Knowing these rules, the names of compounds can be determined based on the molecular structure. Likewise, given an IUPAC name, the -connectivity of the atoms makes it possible to illustrate a structural formula. In general, an IUPAC name will have three essential features:

Substituents + Parent Name + Suffix
(Attachments) (How many carbons are in the longest chain?) (Family Name)

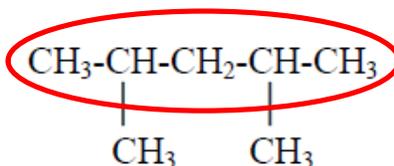
- Names and location of substituents that complete the molecular structure.
- A parent name indicating a major chain or ring of carbon atoms found in the structure.
- A suffix designating functional groups that may be present in the compound.

Steps for Naming Alkanes and Haloalkanes



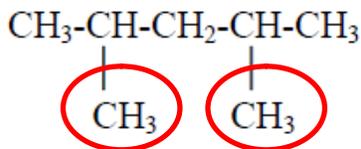
Step 1. Find the longest continuous chain of carbon atoms. This gets the parent (base) name.

# of Carbon Atoms	Prefix	# of Carbon Atoms	Prefix
1	meth-	6	hex-
2	eth-	7	hept-
3	prop-	8	oct-
4	but-	9	non-
5	pent-	10	dec-



The longest continuous chain of carbon atoms in this example contains five carbon atoms. Therefore, the parent name is *pentane*.

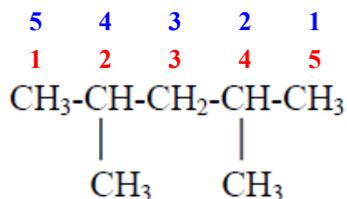
Step 2. Identify the substituents – groups bonded to the parent chain but not included in the parent name. Carbon groups are referred to as alkyl substituents. These are named using the same prefixes as in step 1 to represent the number of carbon atoms present and with the –ane ending replaced with –yl.



Both branches consist of one carbon atom bonded to the parent chain. These substituents are both *methyl* groups (derived from methane).

Naming Alkanes Practice Worksheet

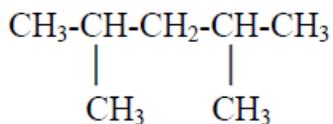
Step 3. Number the carbon atoms in the parent chain starting at the end nearer to a substituent. If there is a tie between substituents, break the tie using the alphabet.



For this compound, it makes no difference which end you start numbering. In both cases, the substituents are located on the second and fourth carbon of the parent chain.

Step 4. Name the compound in the order of: number assigned to substituent based on location, name of substituent followed by the parent name of the compound.

- If there are multiple substituents, name them in alphabetical order at the beginning of the name.
- If there is more than one of the same substituent, apply the prefix di-, tri-, tetra- to the front of the name to indicate two, three, or four of the same type. These prefixes do not count in alphabetizing, i.e., dimethyl is alphabetized by m.
- Separate numbers from words with a dash and separate numbers from numbers with a comma.

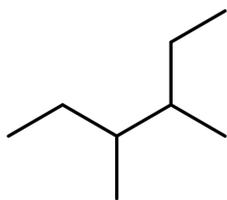


Once all the steps have been combined, it is determined that the name of the compound in this example is **2,4-dimethylpentane**.

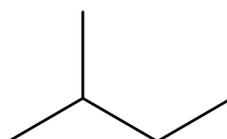
Naming Alkanes Practice Worksheet

1. Give the IUPAC name for each of the following compounds.

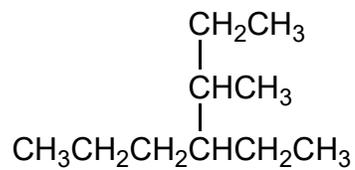
a.



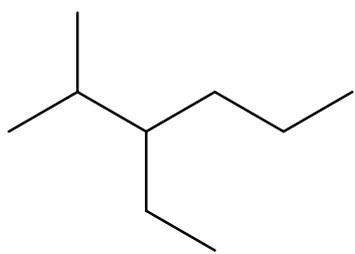
b.



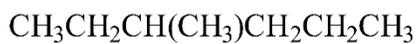
c.



d.



e.



Naming Alkanes Practice Worksheet

2. Use the IUPAC names shown below to draw each structure.

a.

4-ethyl-2,2-dimethylheptane

b.

5,5-diethyl -2,3-dimethyldecane

c.

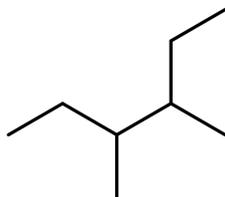
4-isopropyloctane

Naming Alkanes Practice Worksheet

Answers

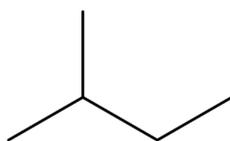
1. Give the IUPAC name for each of the following compounds.

a.



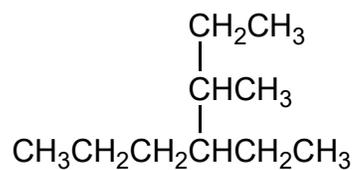
3,4-dimethylhexane

b.



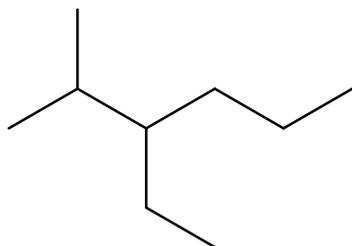
2-butane

c.



4-ethyl-3-methylheptane

d.



3-ethyl-2-methylhexane

e.



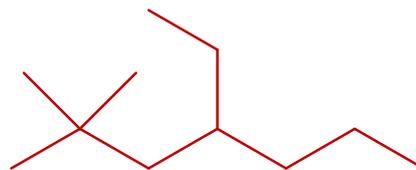
3-methylhexane

Naming Alkanes Practice Worksheet

2. Use the IUPAC names shown below to draw each structure.

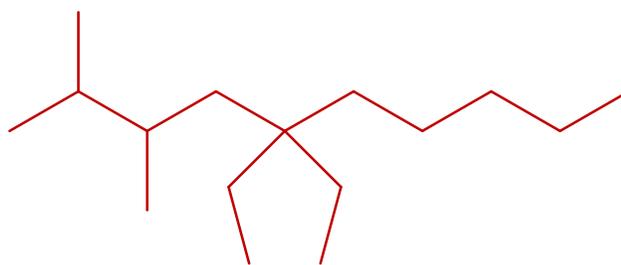
a.

4-ethyl-2,2-dimethylheptane



b.

5,5-diethyl-2,3-dimethyldecane



c.

4-isopropyloctane

