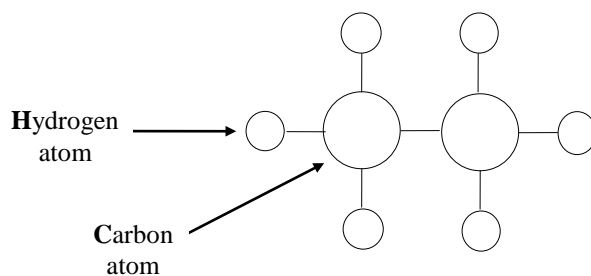


MATHEMATICAL MOLECULES

You may have learned in Science classes that molecules are groups of atoms joined together somehow. If you want to know more about atoms, ask your teacher for more information. This investigation concerns the different possible molecules made by joining Carbon and Hydrogen atoms according to certain rules of chemistry. Such molecules are known as 'hydrocarbons'. The rules that apply are:

- (i) Each Carbon atom must have 4 'links' with other atoms.
- (ii) Each Hydrogen atom must have only one link with other atoms.

If we show these links as short line segments, Carbon atoms as large circles and Hydrogen atoms as small circles, a possible combination involving single links is the Ethane molecule, shown below.



Ethane (C_2H_6)

Can you see why the chemical formula for Ethane is C_2H_6 ?

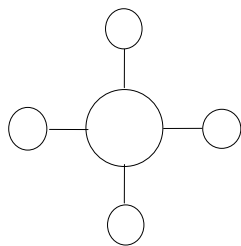
1. Single chain hydrocarbon molecules like Ethane are known as alkanes. Use Geo-Pro's 1 and 2 cm diameter circles to sketch the alkanes listed below. Don't forget rules (i) and (ii) above.
 - (a) Methane (Contains 1 Carbon atom.)
 - (b) Ethane (Contains 2 Carbon atoms.)
 - (c) Propane (Contains 3 Carbon atoms.)
 - (d) Butane (Contains 4 Carbon atoms.)
 - (e) Pentane (Contains 5 Carbon atoms.)
 - (f) Hexane (Contains 6 Carbon atoms.)
2. Write the formula for each molecule you sketched (e.g. C_2H_6 for Ethane.)
3. Can you see a pattern in your answers to question 2? What is it?
4. Without using sketches, state the formula for the following alkanes:
 - (a) Heptane (7 Carbon atoms)?
 - (b) Octane (8 carbon atoms)?
Do you know what octane is used in?
 - (c) One containing 13 Carbon atoms
 - (d) One containing 20 carbon atoms?

Extension:

Investigate molecules involving branches or 'double links' between Carbon atoms.

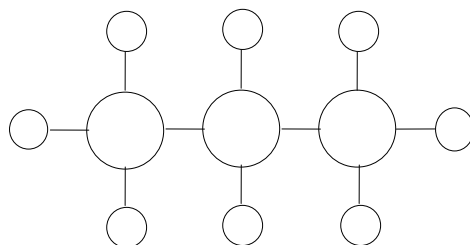
Answers
MATHEMATICAL MOLECULES

1. (a) Methane

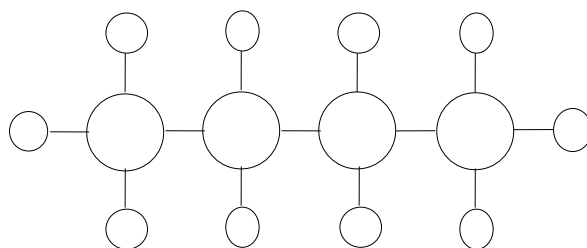


(b) Ethane - See previous page.

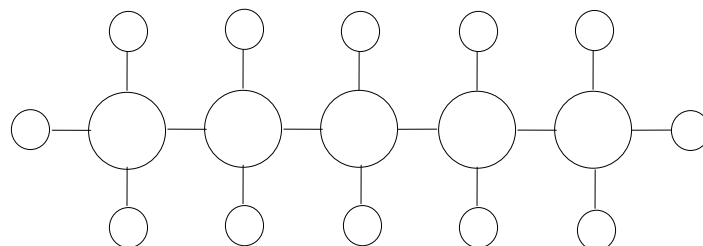
(c) Propane



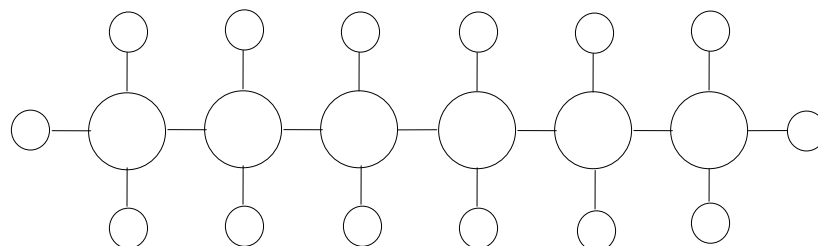
(d) Butane



(e) Pentane



(f) Hexane



2. (a) Methane CH_4
 (b) Ethane C_2H_6
 (c) Propane C_3H_8
 (d) Butane C_4H_{10}
 (e) Pentane C_5H_{12}
 (f) Hexane C_6H_{14}

3. If the number of carbon atoms is n ,
 then the alkane formula is $\text{C}_n\text{H}_{2n+2}$.

4. (a) C_7H_{16} (b) C_8H_{18}
 (c) $\text{C}_{13}\text{H}_{28}$ (d) $\text{C}_{20}\text{H}_{42}$