A Level Chemistry Preparation Project

Task 1

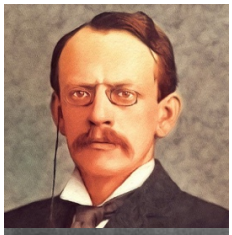
A true understanding of Chemistry depends on a secure knowledge of the structure of matter. We have to understand the structure of atoms and the way that atoms interact to form molecules.

Throughout your science education you have built up a model of what atoms are and how they behave to form molecules.

In this first task we want you to look at how the model of the atom used at GCSE was produced. It takes in information gained through experiments to produce a more and more sophisticated model.

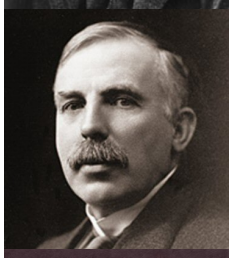
The key scientists involved were:

J J Thomson

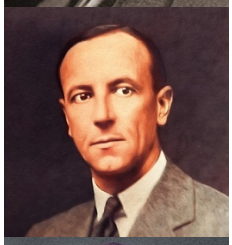


Hantaro Nagoako

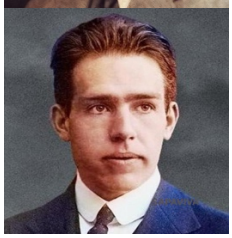
Ernest Rutherford



James Chadwick



Niels Bohr



Part 1

Write an account that shows how the model of the atom developed over time. For each of the scientists, describe their key discovery and show how this led to the model of the atom becoming more sophisticated. Please use diagrams to illustrate the experiments that were carried out as well as the model of the atom developed at each stage.

Part 2

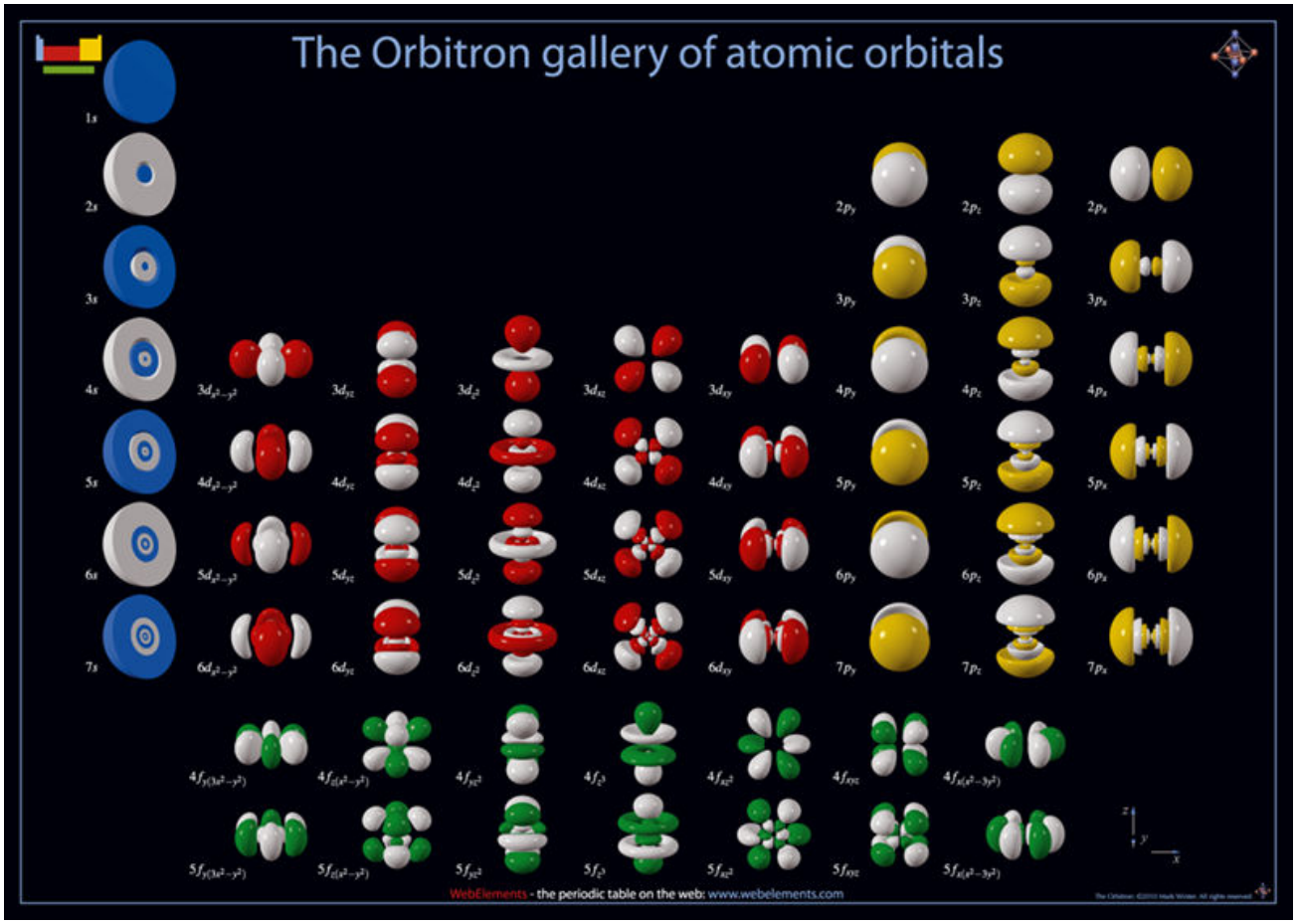
The most sophisticated mode of the atom we use in A Level Chemistry is the orbital model. You will need to research the key features of the model. Some useful sites are:

https://chemrevise.files.wordpress.com/2019/12/1.-atomic-structure-and-periodic-table-edexcel.pdf

https://www.chemguide.co.uk/atoms/properties/atomorbs.html

https://www.chem.fsu.edu/chemlab/chm1046course/orbitals.html

1. What are the key differences between the Bohr model of the atom with electron shells and the orbital model?
2. What evidence made chemists develop the orbital model of the atom from the electron shell model?



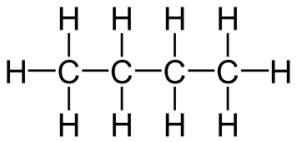
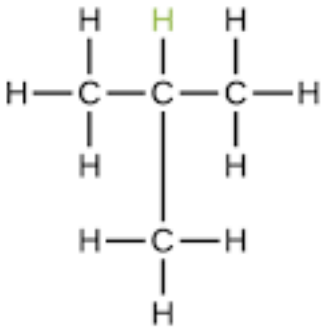
Task 2 Isomers of Hydrocarbons

Hydrocarbons are a type of organic molecule that contains only carbon and hydrogen. Alkanes are hydrocarbons where all the bonds are single bonds. They have the general formula C_nH_{2n+2} where n is the number of carbon atoms in the molecule. Alkenes are hydrocarbons that contain a double bond. They have the general formula C_nH_{2n}.

Alkanes and alkenes can have isomers- molecules with the same formula but the same structure. The way that the carbon atoms are stuck together is different in each version of the isomers.

Example

There are 2 molecules with the formula C_4H_{10}:

	
Butane	Methyl Propane

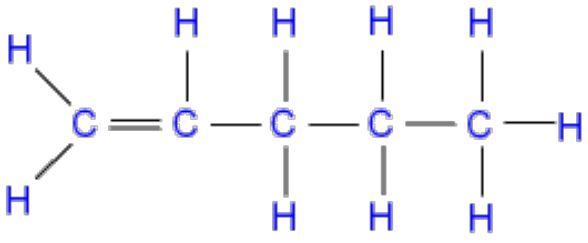
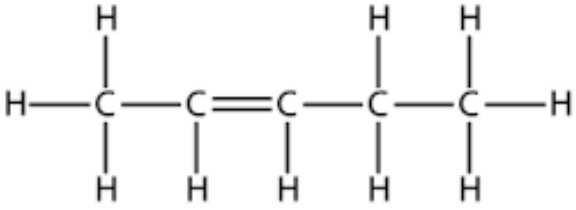
These molecules are isomers as they have the same formula but different structures.

Part 1

Draw the structures of all of the isomers with the formula C_6H_{14}. These molecules will all be alkanes so they will have single bonds between the atoms as in the examples above. You should be able to draw 5 different structures.

Part 2

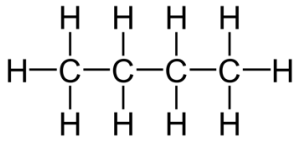
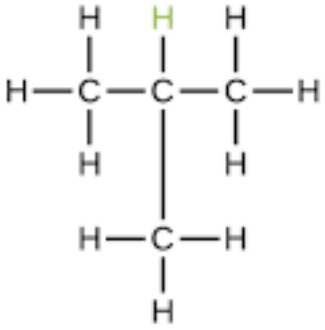
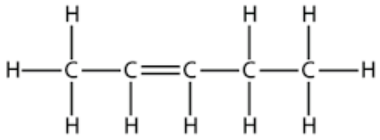
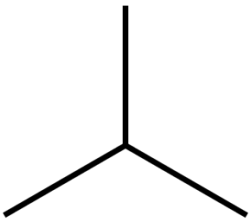
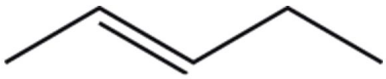
Alkenes have a double bond which increases the opportunities for isomerism. An example of how the position of the double bond can lead to isomers is given below:

	
pent-1-ene	pent-2-ene

Draw the structures of the isomers of C_4H_8. You should be able to draw 4. This may test your creativity!

Part 3- Challenge Task

Apart from the diagrams you have already seen there is another way of drawing hydrocarbons called skeletal formulas. These show the bonds between carbon atoms only. Some examples are:

		
		
Butane	Methyl Propane	Pent-2-ene

a) Draw the skeletal structures of the isomers you determined in part 1.

b) How many of the 16 structural isomers of C_6H_{12} can you draw the skeletal structure of? Here's one to start you off: