

6 DALTON'S ATOMIC THEORY

1. Warm up: How do you define matter? Atom? Molecule?

2. Atoms and atomic structure. http://downloads.bbc.co.uk/schools/gcsebitesize/audio/science_aqa_core/atoms_final.mp3

Read the script of the podcast and suggest a suitable word for each gap. Listen and check. 0 -2.00

It was nearly 3,500 years ago when the idea of an atom was first thought of. The Greek philosopher Demokritos thought that if he took a piece of substance and kept dividing it up, you [he] end up with a tiny particle that you [he] no longer divide. And he called this particle an atom. He had no evidence of this, it was just an interesting idea. And it wasn't until John Dalton in the 19th century, when more was learned by actually doing some experiments.

By carefully weighing chemicals before and after reacting them together, he started to work out a theory about atoms and about how much different types of atom weigh.

The theory says:

- 1) All matter is made up of atoms.
- 2) All of the atoms of one element are
- 3) Atoms can be in chemical reactions and compounds can be made when atoms join together.

Scientists found out that atoms are slightly more complicated: they are not in..... . The atom is made up of tiny heavy central positively , which is made up of protons and and that's surrounded by very light negatively charged

3. Which grammar form is used for theorizing?

Practise here <https://learnenglish.britishcouncil.org/grammar/intermediate-to-upper-intermediate/conditionals-1>

4. Dalton's atomic theory

- Check that you understand the words:

conservation multiple definite proportion ratio property compound

- What three laws does the text mention?

- Complete the gaps with determiners:

each all these other another neither each other nor

Major milestones in the development in chemistry were reached in 1774, when Antoine Lavoisier performed careful experiments and measurements that led to the law of conservation of matter, and in 1799, when Joseph Proust made measurements on chemical reactions and compounds and developed the law of constant composition. The first of these important laws states that in chemical reactions matter is 1 _____ created 2 _____ destroyed. The second law stated that each pure chemical compound always has the same percentage composition of 3 _____ element by mass. These two laws led John Dalton to develop his atomic theory over the years from 1803 to 1808. Dalton's atomic theory stated that:

- 4 _____ matter is composed of tiny indivisible particles, called atoms, that cannot be destroyed or created.
- Each element has atoms that are identical to 5 _____ in all of their properties, and 6 _____ properties are different from the properties of all 7 _____ atoms.
- Chemical reactions are simple rearrangements of atoms from one combination to 8 _____ in small whole-number ratios.

The atomic theory led John Dalton to propose the law of multiple proportions:

When two elements can be combined to make two different compounds, and if samples of these two compounds are taken so that the masses of one of the elements in the two compounds are the same in both samples, then the ratio of the masses of the other element in these compounds will be a ratio of small whole numbers.

For example:

Suppose atoms exist and form molecules of two compounds in which the numbers of atoms of one element are the same (as for carbon in CO and CO₂) and the numbers of atoms of the other element are different (as for oxygen in CO and CO₂). Then the *mass ratio* of the second element in the two compounds (oxygen) would have to be a small whole number ratio (16g to 32g, or a 1-to-2 mass ratio), thus reflecting the small whole number *atom ratio* of the element (1 oxygen atom to 2 oxygen atoms) in the two molecules.

Source: Shipman, Wilson, Todd: Introduction to Physical Science

5. Paraphrases of chemical laws

Supply the titles for the laws under 1 – 3:

1.
This law says that when a chemical reaction rearranges atoms into a new product, the mass of the reactants is the same as the mass of the products.
2.
A law of science that says that a chemical compound is always made up of the exact same proportion of elements by mass.
3.
Statement that when two elements combine with each other to form more than one compound, the weights of one element that combine with a fixed weight of the other are in a ratio of small whole numbers.

6. How to paraphrase:

A. Identify discipline-specialized words (e.g. *compound, catalyst, reactant*)

and words that are generally used for specific things (e.g. *hospital, passport, cash*)

Keep them in your paraphrase; do not change them for synonyms or some indirect expressions.

B. For some of the other words, find synonyms and maybe antonyms as well.

Make sure that the synonym you chose represents the original word in its context, see the definition and examples of use.

For example: is the same – is identical – does not differ from

C. Use changed word forms. Changing the word into a different form makes you change the grammar of a sentence and paraphrase it in your own words.

E.g. development (noun) -> (verb)
..... (noun) -> measure (verb)

D. Change the grammar. Sometimes the change in the grammatical structure helps to paraphrase. We use the knowledge of grammar to make sentence **transformations**. For example, change the sentence below:

When Antoine Lavoisier performed careful experiments and measurements in 1774, the law of mass conservation became generally accepted.

..... *careful experiments and measurements in 1774, Antoine Lavoisier made the law of mass conservation generally accepted.*

Use the strategies to continue paraphrasing the text below.

Dalton's atomic theory and the development of the periodic table by Mendeleev in 1869 led to the rapid growth of chemistry as a science. In particular, the influence of the location and number of electrons in atoms on the properties of elements has become one of the essential ideas of chemistry.

Joesten, Castellion & Hogg: The World of Chemistry, Thomson, 2007, p.40

Joesten, Castellion & Hogg argue that ...

7. Scientific method

"It is a capital mistake to theorize before one has data. Insensibly one begins to twist the facts to suit the theories, instead of the theories to suit the facts."

Sherlock Holmes

A) Which steps do you have to make before you formulate a theory / law? Complete the collocations by matching the nouns in the line and the verbs below.

<i>a hypothesis</i>	<i>an experiment (2x)</i>	<i>conclusion</i>	<i>data(3x)</i>	<i>the question</i>
analyse ...			design ...	
collect ...			draw ...	
conduct (or run) ...			form ...	
define ...			interpret ...	

B) Number the stages from 1-8 in the order you would do them. Compare your answers with the text below.

The scientific method is a process in which experimental observations are used to answer questions. Scientists use the scientific method to search for relationships between items. That is, experiments are designed so that one variable is changed and the effects of the change observed. While the exact methodologies used vary from field to field, the overall process is the same. First, the scientist must define the question – what exactly they are trying to find out. Next comes the formation of a hypothesis, which is an idea or explanation for a situation based on what is currently known. The next stage of the method is the design of an experiment which will allow this hypothesis to be tested. Usually a primary run of the experiment is conducted, and any changes to the experimental set-up made. In each experimental run, data collection takes place, followed by data analysis. Finally, the data is interpreted and from this, the scientist is able to draw conclusions.

Armer, Tamzen: Cambridge English for Scientists

<https://www.naturalreaders.com/online/>