Grade 9 Natural Sciences Worksheet

Atoms and molecules

Part One: The discovery of the atom

1. Who discovered the atom? Do some research to find out the names and contributions of some of the scientists who contributed to our understanding of the structure of the atom. Write your researched findings in the form of point form notes. [12]

2. Now work in groups of 5 or 6. You are going to put together a simulation which explains the history of the atomic theory. Each person in the group can be a scientist from history who contributed ideas to the atomic theory. You can dress up like the character you are playing! Imagine that all these scientists are invited to a television talk show to chat about their contribution to the discovery of the atomic structure. [16]

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Rubric to assess talk show

Criteria	Level 4 [4]	Level 3 [3]	Level 2 [2]	Level 1 [1]
Learner participation	Learner participated fully and with enthusiasm in the group production.	Learner participated with some enthusiasm in the group production.	Learner participated in a limited fashion in the group production.	Learner did not participate satisfactorily in the group production.
Learner discipline in group work	Learner contributed fully and co-operated in a mature fashion, adding to the group's success.	Learner contributed and co-operated in a positive fashion, adding to the group's success.	Learner contributed in a limited way and with limited co-operation.	Learner did not contribute fully; behaviour was disruptive.
Talk show success	Talk show was appealing, varied and fun to watch.	Talk show was interesting to watch.	Talk show was limited in its appeal.	Talk show was boring or didn't make sense.
Content	Content was completely accurate and the participants were well informed.	Content was mostly accurate and the participants were well informed.	Content was limited in terms of accuracy and the participants could have been better informed.	Content was inaccurate and the participants were not well informed.

Part Two: Diagrams to explain differences

Use the following diagrams to explain the difference between:

a) an atom and a molecule

b) an element and a compound

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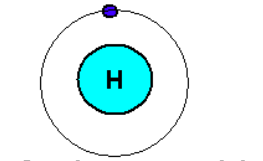
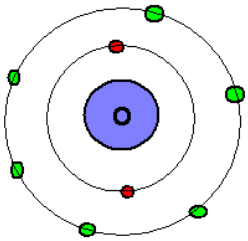
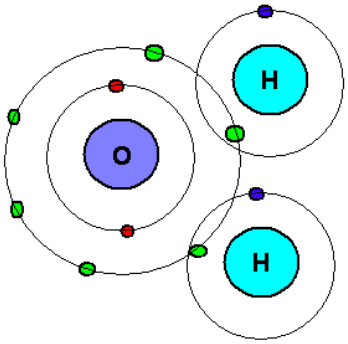


An electron model of a hydrogen atom



An electron model of an oxygen atom



An electron model of a water molecule.

[10 marks]

Part Three: Build molecules

You are going to need a packet of jelly tots and some toothpicks.

Build the following molecules using the jelly tots as atoms and the toothpicks to hold them together. Decide before you start on which colour jelly tots will represent which atom, for example the green ones will be carbon and the red ones will be oxygen.

Now build the following molecules:

Table salt (NaCl), ammonia (NH_3), methane (CH_4), propane (C_3H_8) and chalk or calcium carbonate ($CaCO_3$).

[15 marks]

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Suggested Solutions

Question number	Possible marks	Solution
1.1	12	In ancient Greece, the philosopher Leucippus had a theory that if we keep cutting a piece of matter in half, eventually we would end up with a piece so small that we would not be able to divide it. His protégé, Democritus, named these indivisible pieces of matter "atoms." ✓✓ In 1808 a scientist by the name of Dalton came up with the first atomic theory based on scientific observations. He suggested that all matter is made up of small, hard indivisible atoms and that compounds are formed by joining atoms of elements. ✓✓ Faraday was a scientist interested in electrolysis. His work led him to the conclusion that atoms are not solid spheres, but that they consist of electrically charged particles. ✓✓ According to Thomson (1897) an atom consisted of equal numbers of positive and negative charges and that the negative charges are spread out between the positive matter. ✓✓ In 1907 Rutherford's theory was that an atom consists of a small positive nucleus with electrons around it. ✓✓ A Danish scientist, Bohr (1913) suggested that electrons are found in 'shells' around the nucleus. Electrons with the least amount of energy are found closest to the nucleus and those with more energy are found in shells farther from the nucleus. ✓✓ Chadwick's contribution in 1932 to the atomic model was the discovery of the neutron. He called the subatomic particles that share the space in the nucleus, neutrons because they don't carry a charge. ✓✓
1.2	16	See rubric in Appendix of Assessment Tools.
2	10	An atom has one nuclear core around which the electrons orbit. ✓ It is the smallest unit of matter. ✓ Examples are an atom of hydrogen✓ and an atom of oxygen. ✓ A molecule is formed when two or more atoms ✓ combine/bond together. ✓ When two atoms of hydrogen and one atom of oxygen bond together, a molecule of water is formed. ✓ An element consists of one kind of atom only. ✓ Oxygen and hydrogen are elements. ✓ A compound is formed when atoms of different elements combine. ✓ Water is a compound. ✓
3	15	See diagrams in Appendix of Assessment Tools – award 3 marks per molecule that is completely correct.

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Jelly tot models